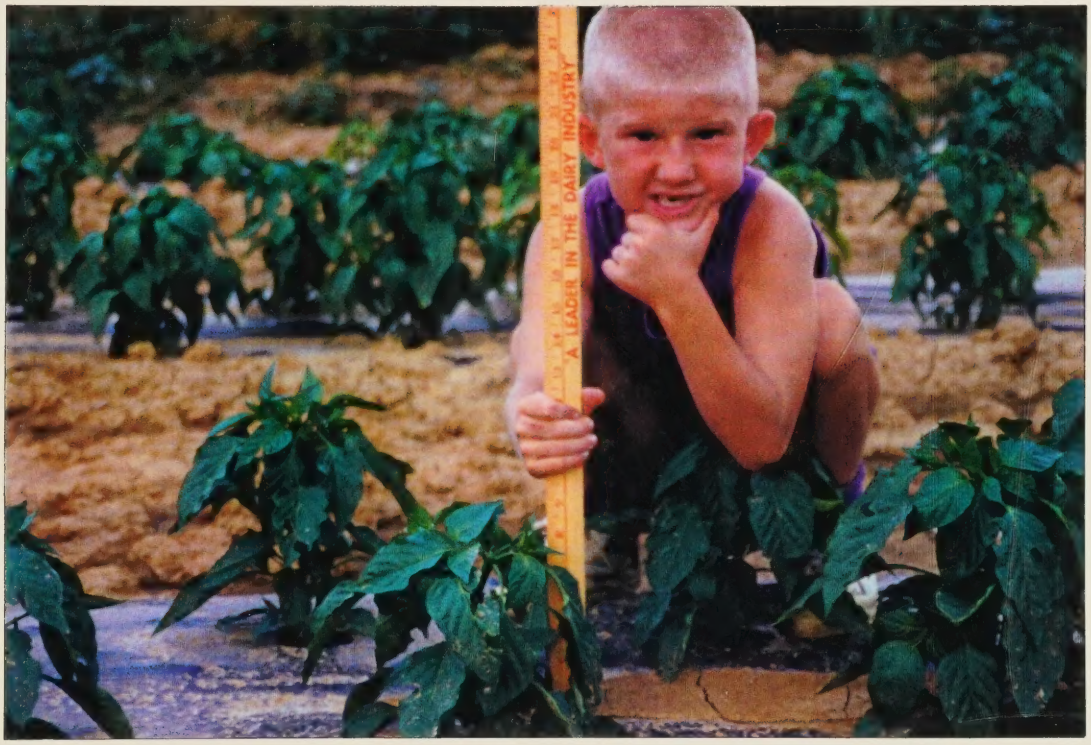
NORTH CENTRAL REGION

Sustainable Agriculture Research & Education



1995 Annual Report

We have not inherited the earth from our fathers.
We are borrowing it from our children.

-Native American Proverb

North Central Region

Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin

Sustainable Agriculture Research & Education

1995 Annual Report

The USDA's Sustainable Agriculture Research and Education (SARE) program is a Federal competitive grants program with regional leadership and decision-making. Authorized by the 1985 Farm Bill, SARE was first funded in 1988. The FY 1996 appropriation totals $11.5 million. SARE's mission is to increase knowledge about, and help farmers adopt, more sustainable practices that are profitable, environmentally sound and beneficial to local communities and society in general. The program provides funding for research, demonstration, education and extension projects carried out by scientists, producers, educators and private sector representatives.

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Credits

Cover Design: **Lisa Bauer**

Editing: **Gabriel Hegyes and Lisa Bauer**

Project Summaries: **Project Coordinators**

Photographs: **Ken Schneider**

PHOTOS

Front Cover: Jordan Churchill, son of Brian and Kelley Churchill of Countryside Farm, DePauw, IN, contemplates the size of his dad's pepper plants. The Churchill's producer grant focused on *Growing Better Crops with IPM.* (Photo taken by the Churchills.)

Inside Front Cover: An example of strip cropping in Lowpoint, IL, is shown. Larry Kennel, operator of Blue Heron Farm, was principle investigator of a project entitled *Strip Cropping in Four Crop Rotations*.

Inside Front Cover: Nolan Jungclaus, Lake Lillian, MN, stands inside a structure converted to a nursery for hogs. Brackets for farrowing boxes can be seen on the back wall. Nolan's project was *Multiphase Swedish Style Hog Production Structure*.

Back Cover: Eric Carlson of Bayfield, WI, shows how a trap in his apple tree baits apple maggots. The project, *Sustainable Organic Apple Production*, demonstrates biocontrol of insects and other disease problems.

Back Cover: Carol Blockstone sits amidst a non-grazed plot of grass on her project site in Ransom, KS. She was studying the *Revegetation and Succession of Western Kansas Riparian Site.*

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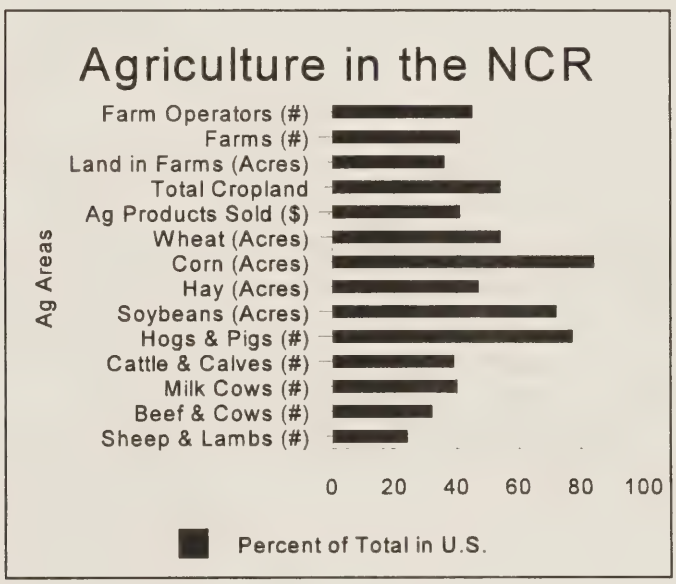
Foreword

The mission of the North Central Region Sustainable Agriculture Research and Education (SARE) program, as articulated in its 1992 Strategic Plan, is:

to create and manage a system designed to encourage the involvement of farm and non-farm citizens in the process of discovery and learning that leads to achieving a more sustainable, environmentally benign agriculture.

In both reflection on our mission and projection into the future of SARE, we consider 1995 to have been a successful year. Our position in agricultural production behooves us to improve the SARE program with each year that passes. We pride ourselves in serving a powerful farming region in the United States -- our 12 states comprise the "Heartland," the "Breadbasket," the grocery cart for America. From the wheat and cattle of the High Plains to the dairy and orchards of the Northeastern states; from the corn, soybeans and tall grass in the Midplains to horticulture in the Ohio River Valley, the North Central Region is large and diverse. As the following 1992 Census Bureau Statistics indicate, we have a crucial role to play in shaping a more enduring agriculture.



It's interesting to note that of the United States' most common crops and animal products, the North Central Region produces at least 30 percent. We also grow 84 percent of grain and seed corn, 72 percent of soybeans, and 54 percent of wheat. Almost half the farmers in the U.S. make their living here, and over half of the nation's cropland lies on North Central Region soil.

To reiterate, the North Central Regoin SARE program has a tremendous opportunity to influence agriculture on a large scale. We continued to take that opportunity in 1995 by enhancing the dialogue on a more sustainable system of food production through our grants program. We have fostered better communications between researchers and farmers, focused attention on whole-systems research, strengthened the bond between Research and Education and the Professional Development Program[1], and thought futuristically by involving young people in our projects.

It is important to note that the backbone of our success lies in the conviction of people involved in the NCR SARE program -- farmers, Administrative Council & Technical Committee members, researchers, Extension, university representatives, non-profit groups and state and regional government. Without the endeavors of these and others in the North Central Region, our goals would not be been brought to fruition, and the list of highlights below would be short.

HIGHLIGHTS

Research and Education Grant Program:

- In line with our commitment to all facets of sustainable agriculture, we shifted priority from merely production research to social science research. The Administrative Council established a separate grant category for **socieo-economic issues**, investing $300,000 in projects addressing quality of life and the structure of agriculture.

- Six other **priority areas targeted for SARE funding** were: 1) value added/regional food systems; 2) sustainable weed management systems; 3) sustainable livestock systems; 4) integration of food, environmental and agricultural policy; 5) farmer based/initiated networks: beginning farmers and partnerships with enablers; and 6) system approaches to manure management for plants, animals and the environment.

[1] The 1990 Farm Bill (FACTA) designates the Research and Education grant program as *Chapter 1* and the Professional Development Program as *Chapter 3* under the section regarding Sustainable Agriculture Research and Education (SARE).

- In addition, two EPA **Agriculture in Concert with the Environment (ACE) funding areas** were established: 1)ACE I, environmentally sensitive areas and environmentally sound management; and 2) ACE II, a special Bio-pesticide Call for Proposals.

- Our Administrative Council established a **Marketing Committee** to assess marketing needs related to sustainable agriculture in this region and determine whether there is a need for a targeted grant category in marketing. This process led the SARE program to approve a national initiative on marketing sustainable agriculture products.

- As we have in previous years, the North Central Region continues to emphasize **producer involvement and adoption of research**. We require all research and education grants to have producer involvement through project planning, implementation, outreach and/or analysis of results.

Producer Grant Program:

- Our commitment to farmers is most evident in our **strong producer grant program**. The Administrative Council hiked funding for this program in 1995.

- Ken Schneider's presence as our **full-time Program Coordinator for Field Operations** best illustrates the North Central Region's focus on producers. In completing his first year with us, Ken traveled 13,760 miles throughout all 12 states to visit 40 active project sites. He has also: reviewed and processed 33 final reports; attended field days; attended a training session in Salt Lake City on Access 2 Data Base; presented the Producer Grant Program at a Pollution Prevention Round table in Nebraska; and facilitated networking among farmers.

- Ken collected an informal survey of producers' satisfaction of the North Central Region SARE program. Results showed that **83 percent of ratings were above average**, 16 percent average and only 1 percent below average. All respondents expressed complete support and enthusiasm for the NCR Producer-Initiated Grant Program.

Professional Development Program:

- The goals of the North Central Region's PDP grant program continue to be met. We continue to train Cooperative Extension field staff, campus-based specialists, Natural Resources Conservation Service employees, and other members of the agricultural community in practices and concepts of sustainable agriculture.

- In 1995, we held a **planning workshop** in Cedar Rapids, IA, that brought together 70 farmers, county educators, specialists, administrators and federal agency people to share materials, learning methods and experiences on training for sustainable agriculture.

- We also held two **regional professional development workshops,** entitled "Everyone a Teacher, Everyone a Learner,"which took place in Nebraska City, NE, and Turkey Run, IN.

- Several other regional and two-state planning sessions were held throughout 1995, including major **two-day training sessions in the Dakotas**. A total of 210 individuals participated in the training, including 170 Extension staff, 17 NRCS staff, 7 persons from the Soil Conservation Districts and 16 other individuals representing various state and federal agencies and organizations. Ninety-seven percent of the participants indicated that the workshop contained helpful information they will use in their professional activities.

- The North Central Region was responsible for facilitating a call for production of a **video on training in sustainable agriculture**.

- The Administrative Council also allocated $15,000 to each North Central Region land grant institution to help them implement state strategic plans in sustainable agriculture.

- Eight additional professional development projects were funded in this region.

Administrative Council/Technical Committee:

- The NCR AC continues to be a **diverse body of knowledgeable and dynamic sustainable agriculture proponents**, including Extension, research/university, farmer/non-profit, and governmental agency representatives.

- Our executive committee Chair, Tom Guthrie, was a **producer** from Michigan -- further proving our commitment to farmer involvement in this region.

- During a June 1995 meeting, the NCR AC traveled to Cable, Wisconsin, to visit a *Sustainable Community Values* project and a seasonal grazing dairy operation funded by the Minnesota State Department of Agriculture.

- In the AC's tradition of looking forward in sustainable agriculture, they held a **strategic planning session**, led by Dave Nelson, to review and define NCR SARE's mission and goals as stated in 1992.

- In March, the NCR SARE initiated an **orientation for Technical Committee** members and prepared a **handbook** containing policy and procedure for their review.

NCR Staff

- The North Central Region committed to writing the first ***Grant Writing Guide*** to help farmers and researchers hone their applications for funding.

- We also committed funding for a full-time communications specialist in this region.

- Communications in the NCR SARE program included: providing producers with information, support materials (displays, publications and speaker's bureau); preparing a synopsis of progress by Chapter 1 projects and developing publications and regional and national materials from that information; preparing copy and coordinating development of a national SAN publication, ***Dairy Options***, and contributing to other SAN products; and providing support for Administrative Council priorities, including the Marketing Committee.

*The North Central Region would like to express gratitude to **Lisa Brown-Jasa**, former communications specialist, for her dedication and quality work for the NCR SARE program. Her pioneering efforts mark the first communications specialist position regionally and nationally in SARE. Thanks for your service, Lisa!*

NCR SARE Project Funding Overview

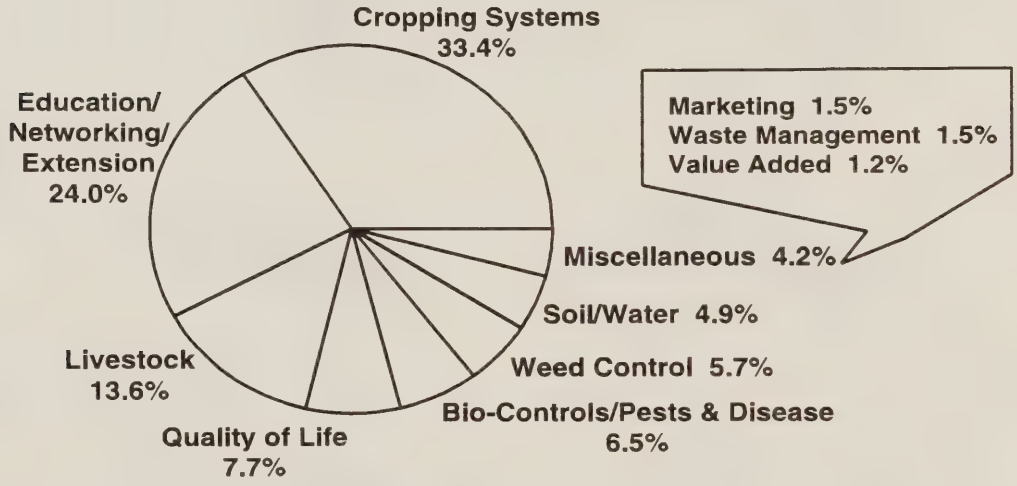
Projects Funded 1988-1996
By Category

Crop Production		**2,898,826**
- Corn/Soybeans	1,389,520	
- Wheat/Small Grains	923,581	
- Fruits/Vegetables/Other	585,725	
Education/Networking/Extension		**2,084,130**
- Farmer/Farmer	783,215	
- Beginning Farmers	667,780	
- Educational Materials	270,681	
- Educating Educators	159,232	
- Educational Demonstrations	203,222	
Livestock Production		**1,183,308**
- Beef	740,547	
- Dairy	297,448	
- Swine	145,313	
Quality of Life		**667,352**
- 1988-95 SARE	430,168	
- Socioeconomic Call 1995	237,184	

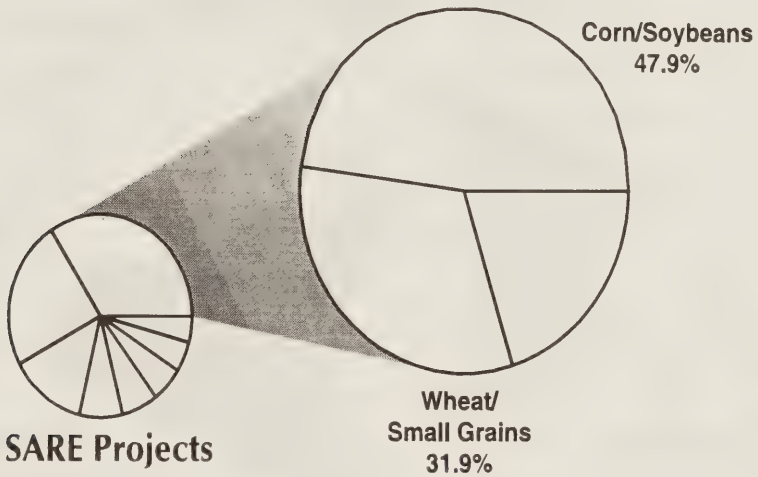
Biological Controls		**493,150**
- Fruit Pests	67,700	
- Crop Pests	321,168	
- Foliar Diseases	173,580	
Weed Control		**562,448**
- Corn/Soybeans	350,150	
- Wheat	73,000	
- Vegetable	70,000	
Soil/Water		**427,839**
- Soil Nutrients/Microbes	281,423	
- Water Quality	128,638	
- Wetlands	17,778	
Marketing		**133,942**
- Swine	133,942	
Waste Management		**129,009**
Value-Added		**100,300**
Total		**8,680,304**

SARE Projects by Category

NCR 1988-1996

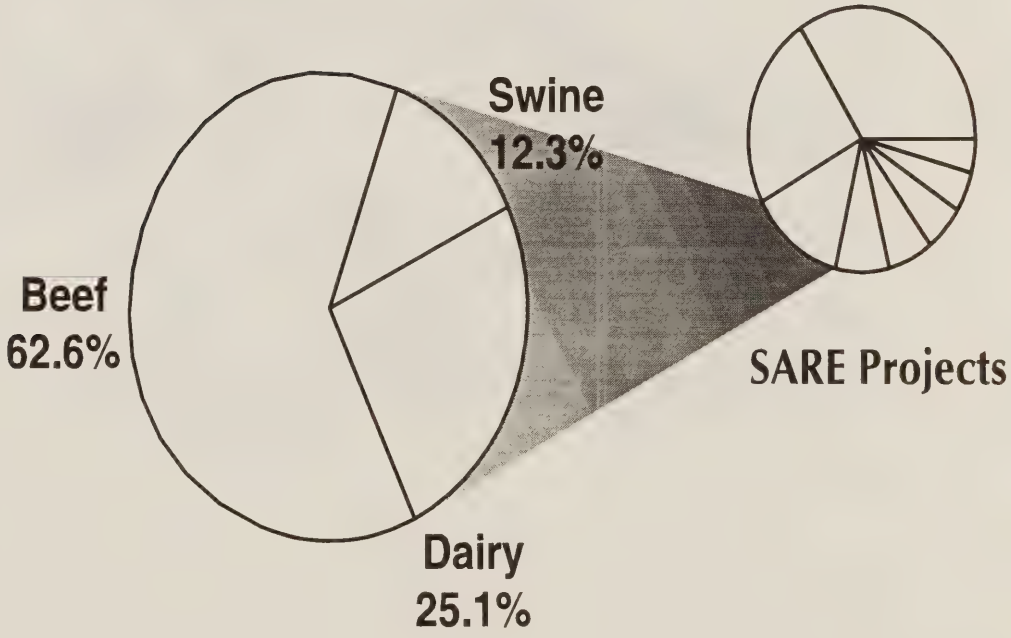


SARE Cropping Systems Projects
NCR 1988-1996

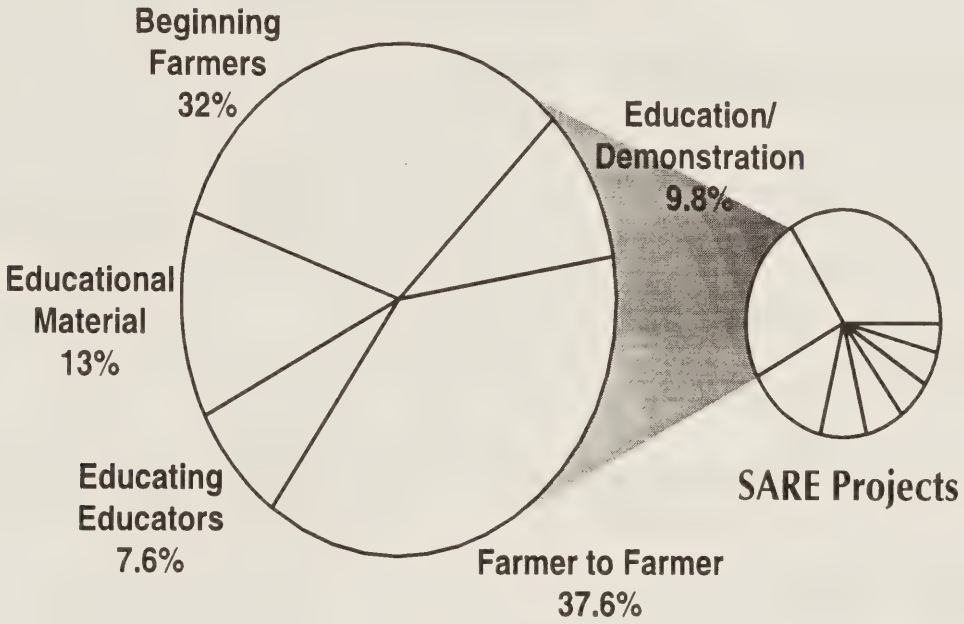


SARE Livestock Projects

NCR 1988-1996



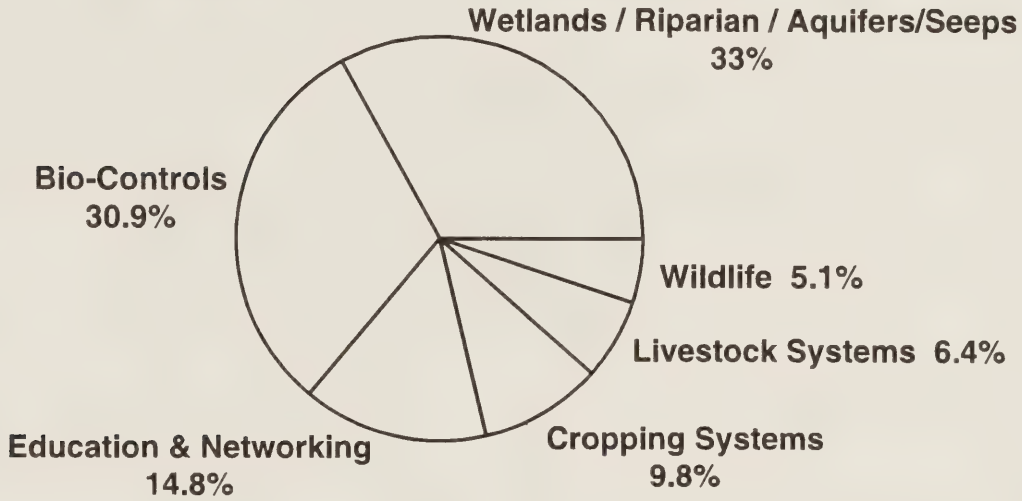
SARE Education/Networking/Extension Projects NCR 1988-1996



Projects Funded 1991-1996
By Category

Riparian/Wetlands/Aquifers/Seeps		**$624,908**
- Aquifers	63,000	
- Riparian	232,908	
- Wetlands	269,000	
- Seeps	60,000	
Biological Controls		**585,196**
- Insects	196,941	
- Weeds	158,277	
- Vegetative Disease	187,649	
Education/Networking		**279,950**
- Adult	202,500	
- Youth	77,450	
Farming Systems		**186,204**
- Corn/Soybeans	99,262	
- Fruit/Vegetables	86,942	
Livestock		**120,047**
- Dairy	68,230	
- Beef	51,817	
Wildlife		**96,100**

ACE Projects by Category
NCR 1991-1996



Producer Grants Funded 1992-1995

Grants Awarded - 128 **Grants Declined - 3** **Projects Funded - 125**

Livestock - 49
Crop Production - 34
Urban and Rural Waste - 14
Weed Control - 10
Soil Conservation and Water Quality - 6
Bio-Pest Control - 6
Quality of Life - 2
Value-Added - 2
Education - 2

Status of Funded Projects

	1992	1993	1994	1995
Complete	20	30	23	0
Active/Extensions	3	0	8	38
Inactive-	1	1	0	1
Total	24	31	31	39

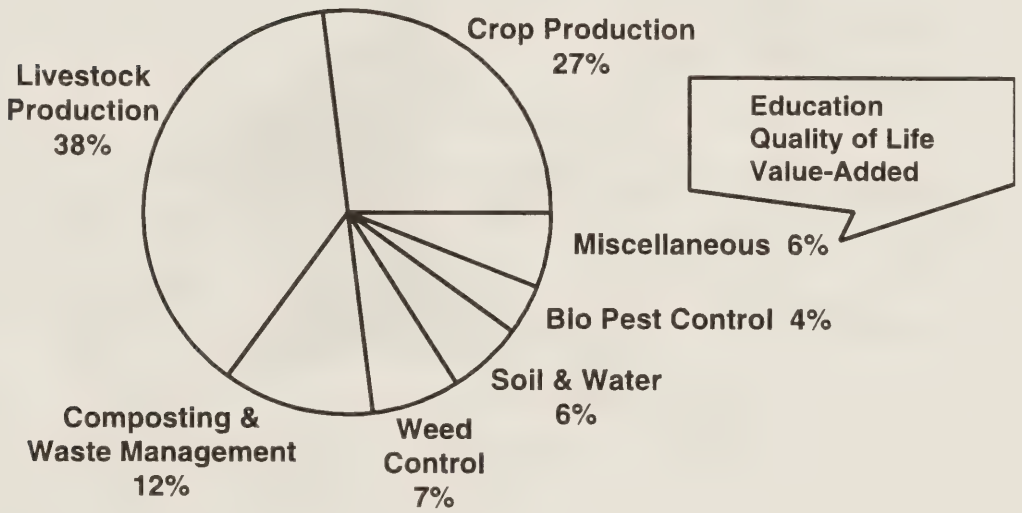
Grants Awarded Per State

	1992	1993	1994	1995	Total
Nebraska	3	4	6	6	19
Michigan	1	6	6	4	17
Kansas	8	4	3	1	16
Minnesota	2	5	3	5	15
Wisconsin	5	5	2	3	15
Iowa	2	3	2	4	11
Missouri	1	1	2	4	8
Illinois	1	2	2	2	7
Ohio	1	0	1	5	7
North Dakota	1	0	2	3	6
Indiana	1	1	1	2	5
South Dakota	0	0	1	1	2
Total	26	31	31	40	128

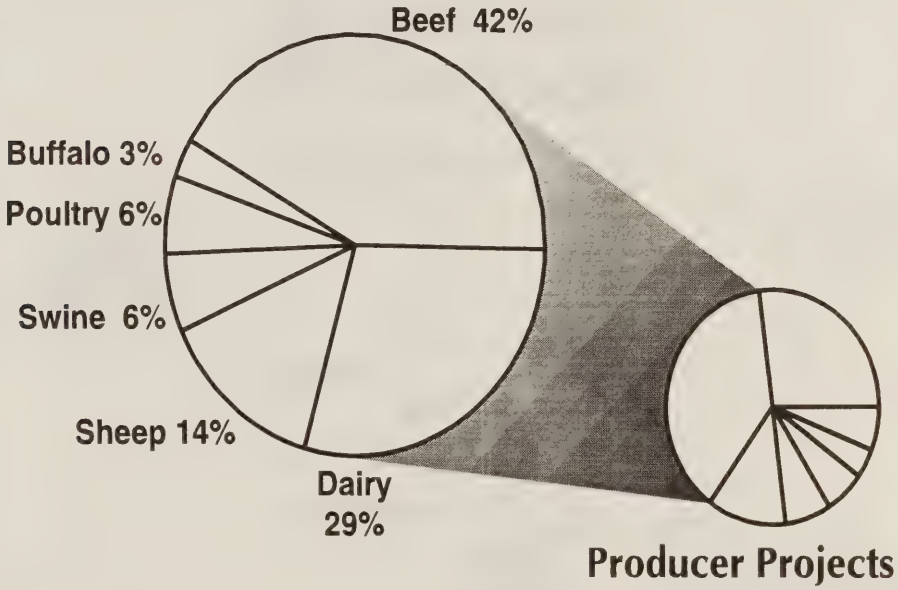
Grazing and Livestock		**166,562**
- Beef	69,464	
- Dairy	48,673	
- Sheep	22,922	
- Swine	10,277	
- Poultry	10,226	
- Buffalo	5,000	
Crop Production		**114,233**
- Organic	47,167	
- Specialty	21,092	
- Companion and Cover	15,148	
- Crop Rotation	15,428	
- Equipment	8,818	
- Residue Management	6,580	
Composting and Waste Management		**51,204**
Weed Control		**31,786**
- Cultural	17,934	
- Biological	13,852	
Soil and Water		**28,197**
- Riparian	9,675	
- Water Quality	9,182	
- Wet Meadows	5,000	
- Earthworms	4,340	

Biological Pest Controls		**19,656**
- Fruit	12,937	
- Vegetables	3,175	
- Potato	2,044	
- Livestock	1,500	
Education		**9,996**
Quality of Life		**8,600**
Value Added		**6,700**
Total		**436,934**

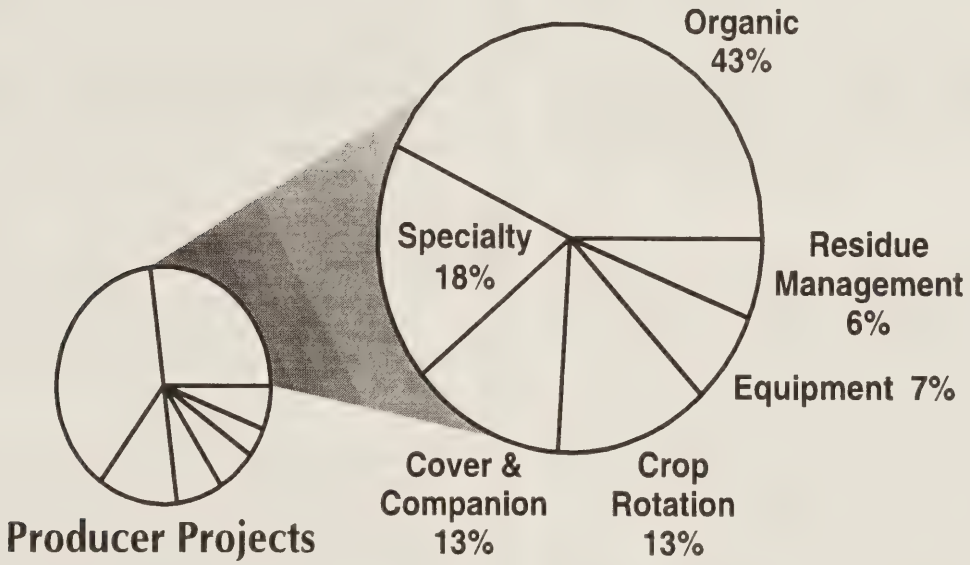
Producer Initiated Projects by Category NCR 1992-1995



Livestock Production Projects



Crop Production Projects



NCR Producer Grants Funded 1992-1995

Crop Production Systems

Companion Crops

Winter Rye as Companion Crop in Establishment of Alfalfa (FNC 93-29). Gary Young, Rt. 1, Box 27, McLean, NE 68747. Phone: (402) 586-2998.

Cover Crops

Evaluation of Various Legumes for Use as Green Manure Cover Crops (FNC 92-1). Phil and Barbara Hueneke, R.R. 2, Box 126, Bellevue, IA 52031. Phone: (319) 872-4327.

Annual Alfalfa and Berseem Clover Interseeded into Winter Wheat for Fall Grazing and Green Manure (FNC 92-4). Oren Holle, Rt. 1, Box 108, Bremen, KS 66412. Phone: (913) 337-2662.

No-Tilling Hairy Vetch Into Crop Stubble and CRP Acres (FNC 93-28). Walt Townsend, Rt. 1, Box 77, Geff, IL 62842. Phone: (618) 897-2560.

Living Mulches in Minnesota Wheat (FNC 95-91). Dave Birong, 35805 535th Ave., Grove City, MN 56243. Phone: (616) 857-2772.

Measuring Nitrogen Benefits of Hairy Vetch Cover Crop for Corn Production and Evaluating a Portable Soil Nitrate Test Kit (FNC 95-108). Rich Bennett, 7-740 Road P-3, Route 5, Napoleon, OH 43545. Phone (419) 748-8187.

Cover Crop Management in the Upper Midwest (FNC 95-117). Kim A. Burkhart, 3597 W. Lightsville, Leaf River, IL 61047. Phone: (815) 738-2392.

Crop Rotations

Development of Sustainable Crop Rotation System (FNC 92-25). Kenneth Wallingford, Jr., 10624 242 Rd., Effingham, KS 66023. Phone: (913) 886-6706.

Strip Cropping in Four Crop Rotation (FNC 94-63). Larry Kennel, Rt. 1, LowPoint, IL 61545. Phone: (309) 443-5257.

Interseeding Field Peas and Yellow Mustard for Enhanced Moisture Retention and Harvesting Ease in a No-Till Cropping System (FNC 95-90). Vern Mayer, HCR 1, Box 81, Regent, ND 58650. Phone: (701) 563-4631.

Implement Sustainable and Organic Practices Using Rotary Tillage and No-Till Equipment to Farm in 30 ft. Strips That Will Meet ASCS Erosion Mandates (FNC 95-99). Larry Kennel, RR 1, Lowpoint, IL 61545. Phone: (309) 443-5257.

Residue Management

Strip Tilling Sunflowers Into Small Grain Residue (FNC 92-16). Lawson Jones, Rt. 2, Box 90, Webster, ND 58382. Phone: (701) 395-4437.

Soil Conservation and Residue Management Demonstration (FNC 93-52). Clair Niles, Rt. 2, Lebo, KS 66856. Phone: (316) 256-6262.

Weed Control

Biocontrols

Bio-Control of Leafy Spurge Using Angora Goats (FNC 93-27). Marvin Lange, HC16, Box 6, Fordyce,NE 68736. Phone: (402) 357-2150.

Bio-Control of Plumeless Thistle (FNC 93-30). Gary Young, Rt. 1, Box 27, McLean, NE 68747. Phone: (402) 586-2998.

Bio-Control of Leafy Spurge (FNC 94-73). Dennis Dietz, Box 247, Sentinel Butte, ND 58654. Phone: (701) 872-4757.

Continued Study of Controlling Leafy Spurge Utilizing Angora Goats (FNC 94-74). Marvin Lange, HC 15, Box 6, Fordyce, NE 68736. Phone: (402) 357-2150.

Biological Control of Canada Thistles (FNC 95-119). Dennis Demmel, Rt. 1, Box 286, Ogallala, NE 69153. Phone (308) 352-4078.

Machinery and Cultural Practices

Evaluation of Ridge Tilling With and Without Herbicides (FNC 92-2). Ron Rosmann, 1222 Ironwood Rd., Harlan, IA 51537-4102. Phone: (712) 627-4653.

Weed Control and Fertility Comparisons in Solid Seeded and 30" Row Soybeans (FNC 92-7). David Michaelson, River Glo Farms, P.O. Box 410, Dawson, MN 56232-0410. Phone: (612) 769-4683.

Weed Control in Sugar Beet Production Utilizing Ridge Tillage and Cover Crops (FNC 92-13). Alan Brutlag, R.R. 1, Box 41, Wendell, MN 56590. Phone: (218) 458-2114.

Non-Chemical Weed Control in Row Crop Production (FNC 93-48). Jerome Berning, P.O. Box 151, Marienthal, KS 67863. Phone: (316) 379-4682.

Weed Management Methods for Strip Intercropping (FNC 94-82). Bruce Krueger, Rt. 1, Box 218, Arlington, NE 68002-9659. Phone: (402) 478-4596.

Composting and Waste Management

Municipal and Urban Waste

Composting Rural and Urban Waste (FNC 93-50). Marlin Goebel, 24885 Morrow Road, Hillman, MI 49746. Phone: (517) 742-4505.

Utilizing Chopped Waste Paper for Bedding in Hog Operation (FNC 94-62). Daryl Bridenbaugh, Road 5-N14282, Pandora, OH 45877. Phone: (419) 384-3371.

On-farm Food Waste Composting (FNC 95-112). Larry A. Whinery, 188 E 100 S, Huntington, IN 46750. Phone: (219) 468-2345.

Rural Waste

Comparing Various Rates and Application Methods of Liquid Swine Manure in Grain Sorghum Production (FNC 92-3). Darrell and Donna Parks, 1001 East 26th Ave., Manhattan, KS 66502. Phone: (913) 539-1930.

Manure Composting in Dairy Operation (FNC 93-37). George Shetler, 5436 Tyler Road S.E., Kalkaska, MI 49646. Phone: (616) 258-8216.

Potassium Uptake in Relation to Manure Application and Tillage Practices (FNC 93-39). Dick and Sharon Thompson, 2035 190th St., Boone, IA 50036. Phone: (515) 432-1560.

Comparing Composted and Raw Manure in Crop Production (FNC 93-45). Rich Vander Ziel, Rt.1, Box 133, Chandler, MN 56122. Phone: (507) 879-3541.

Evaluating Liquid Manure as Nutrient Source in a Commercial Orchard (FNC 93-49). John Muma, 15505 Laketon Ave., Casnovia, MI 49318. Phone: (616) 675-7589.

Continuing Study Relating Potassium Uptake to Manure and Tillage (FNC 94-60). Dick and Sharon Thompson, 2035 190th St., Boone, IA 50036-7423. Phone: (515) 432-1560.

Composting Swine Carcasses (FNC 94-77). Ed Fisher, Raisin Ridge Farms, 2315 Rogers Hwy., Adrian, MI 49221. Phone: (517) 423-4763.

Low Cost Waste Management in Beef Cattle Operation (FNC 94-79). Joel Rissman, 10330 State Route 23, Waterman, IL 60556. Phone: (815) 264-3487.

On-Farm Composting of Livestock Manure (FNC 94-83). Joe Slater, 6780 Brunswick Road, Holton, MI 49425. Phone: (616) 821-2843; and Bob Wackernagel, 6673 W. Fruitvale Rd., Montague, MI 49437; Phone: (616) 893-0087.

Composting Poultry and Swine Carcasses (FNC 95-93). Mark Hart, Rt. #6, Box 241, Portland, IN 47371. Phone: (219) 335-2482.

Specialty Crops

Hazelnut Windbreak Adds Diversity (FNC 93-34). Phillip Brase, Rt. 3, Box 123, Waseca, MN 56093. Phone: (507) 455-2615.

Hazelnuts for Windbreak and Alternative Cash Crop (FNC 93-42). Michael Natvig, Rt. 2, Box 215, Cresco, IA 52136. Phone: (319) 569-8757.

Utilizing Native Sandhill Plum as Income Producing Windbreak (FNC 94-68). Brenda Olcott-Reid, P.O. Box 247, Chetopa, KS 67336. Phone: (316) 236-4254.

Wild Flowers on Marginal Lands (FNC 94-72). Frank J. Kutka, 1451 County Rd. 6 East, Barnum, MN 55707. Phone: (218) 389-3220.

Harvesting Wildflower Seed Crops from Marginal Lands (FNC 95-98). Frank J. Kutka, 2323 County Rd 6, Barnum, MN 55707. Phone: (218) 389-3220.

Native Elderberry and Plum as Income Source from Waste Ground (FNC 95-106). Nancy Jorgensen, Route 1, Box 23, Dawson, NE 68337. Phone: (402) 855-2265.

Organic Farming and Gardening

Bio-Weed Control in Farm and Garden Situations (FNC 92-12). Robin Rohlfing, Route 1, Box 108, Plymouth, NE 68424. Phone: (402) 656-3387.

Hairy Vetch as Weed Control Cover Crop in Vegetable Production (FNC 92-14). James Rose, Earthcraft Farm, R.R. 1, Box 226-C, Bringhurst, IN 46913. Phone: (317) 268-2669.

Production and Marketing of Organic Beef (FNC 92-24). Kathy Thiel, 16104 South Fordney Road, Chesaning, MI 48616. Phone: (517) 845-2696 or 845-6707.

Clear Hilum Organic Soybean Trials (FNC 93-41). David and Tom Vogelsberg, Rt.1, Home, KS 66438. Phone: (913) 799-3772.

Implementing Sustainable Agricultural Practices to Attain Organic Certification (FNC 94-65). Mid Michigan Sustainable Organic Growers Assn., Bob Carriveau, 1135 Ash St., Beaverton, MI 48612. Phone: (517) 435-3509.

Sustainable Organic Apple Production (FNC 94-75). Eric Carlson, HCR 64, Box 71A, Bayfield, WI 54814. Phone: (715) 779-3698.

Cooler Development for Organic Meats and Produce (FNC 94-85). Dan Nagengast, Rolling Prairie Farmers Alliance, 1012 E. 1700 Road, Lawrence, KS 66046. Phone: (913) 841-1959.

Hairy Vetch in Minimum Till Organic Rotation (FNC 94-87). James Ryan, HC1, Box 13, Balfour, ND 58712. Phone: (701) 525-6615.

Developing Weed Control Methods for Organic Raspberry Producers (FNC 95-102). Kevin Edberg, 2408 Ronald Avenue, White Bear Lake, MN 55110. Phone: (612) 296-6382.

Building Community in CSA's: A Canning Project (FNC 95-105). Rosalie Franek, Butternut Hill Farm, 12232 St., Rt. 700, Hiram, OH 44234. Phone: (216) 569-7782.

Alternative Strategies for Building Soil and Soil Erosion (FNC 95-107). Vincent Meyer, Olaf Anderson, Tracy Reyelts, RR 1, Box 95, Milbank, SD 57252. Phone (605) 432-4096.

Permanent Raised Bed Organic Mulching for Specialty Crops (FNC 95-114). Terrance M. Loomis, 30800 Hardwood Lane, Red Wing, MN 55066. Phone (612) 388-1043.

Orchard Mason Bees - Collection & Use in Southwest Wisconsin (FNC 95-121). Ryan Wilson, W. 8247 Cty P., Browntown, WI 53522. Phone: (608) 325-5215.

Equipment Testing and Improvement

Converting Windrower into an Efficient, Affordable Compost Turner (FNC 92-9). William and Elizabeth Kleinschmidt, R.R. 3, Box 185, Hartington, NE 68739. Phone: (402) 357-2217.

Evaluation of Rotary Spader as Primary Tillage Tool in Various Soils (FNC 92-26). Christopher Werronen, The Lake-Geauga CSA Project, 8345 Brakeman Rd., Leroy Township, OH 44077. Phone: (216) 254-4528.

Utilizing Portable Scale to Evaluate Crop and Livestock Production (FNC 93-31). Tom Frantzen, 1155 Jasper Ave., New Hampton, IA 50659. Phone: (515) 364-6426.

Nitrogen Management on Sandy Soils for Environmentally and Economically Sustainable Corn Production (FNC 95-113). Edmond Groholski, 1230, 12 Mile Rd., Burlington, MI 49029. Phone (517) 765-2111.

Livestock Production

Beef

Fall Sown Rye for Fall and Spring Grazing and Green Manure (FNC 92-17). Lee Quaintance, Rt. 1, Box 159, Edgerton, KS 66021. Phone: (913) 893-6797.

Evaluation of Rotational Grazing in Established Mixed Grass Pasture, and Interseeding Legumes into Winter Wheat (FNC 92-20). Charles McNeal, 2154 W. 240th Drive, Paradise, KS 67658. Phone: (913) 885-4436.

Comparing Broadcasting and No-Till in Legume Establishment and Using Beef Tallow for Round Bale Weather Protection (FNC 92-21). Tim Kunnard, R.R. 1, Box 143A, Edgerton, KS 66021. Phone: (913) 883-4788.

Establishment of Native Warm Season and Cool Season Grasses on Highly Erodible Land (FNC 92-22). Michael and Debi Herren, R.R. 1, Box 77, Kampsville, IL 62053. Phone: (618) 653-4254.

Intensive Rotational Grazing System in the Flint Hills of Kansas (FNC 92-23). Pete Ferrell, P.O. Box 59, Beaumont, KS 67012. Phone: (316) 843-2721.

Evaluating and Comparing Beef Cattle Grazing Systems (FNC 93-32). Don Fox, Rt. 1, Box 154, Fairbury, NE 68352. Phone: (402) 729-5957.

Transition from Confinement to Grazing in Beef Cattle Production (FNC 93-47). Francis, Jr., and Lou Ann Leuken, Rt. 1, Box 173, Ferdinand, IN 47532. Phone: (812) 367-2510 or (812) 367-1096.

Establishment of Warm Season Grasses and Interseeding Legumes Into Cool Season Pastures (FNC 93-53). Ted Rolling, Rt. 1, Box 109A, Ivanhoe, MN 56142. Phone: (507) 694-1483.

Establishment of Cool Season Pasture in Nebraska Sandhills (FNC 94-59). Gregory and Timothy Nollette, Diamond Lazy J Ranch, P.O. Box 100, Nenzel, NE 69219-0100. Phone: (402) 823-4131.

Pasture Renovation and Reseeding (FNC 94-66). John and Deb Milbocker, 5390 Douglas Lake Road, Johannesburg, MI 49751. Phone: (517) 939-8823.

On-farm Grazing Systems Research and Development of Intensive Grazing Software (FNC 94-67). Robert Cessac, 2362 State Road O, Higbee, MO 65257. Phone: (816) 248-5201.

CRP Research Project--Comparing Alternative Uses of CRP Acres (FNC 94-69). Kenneth Widener, Rt. 2, Box 96, Tekamah, NE 68061. Phone: (402) 377-2788.

On Farm Systems Research to Raise Slaughter Ready Beef on Pasture and Grain, and Market Development (FNC 95-92). Robert J. Cessac, 2362 State Road O, Higbee, MO 65257. Phone: (816) 248-5201.

Intensive Grazing Economic Study (FNC 95-95). Dr. M. O. Pitcher, 5547 Caves Road, Maquoketa, IA 52060. Phone:(319) 652-4623.

Nebraska CRP Research Project-Comparing Alternative Uses of Land Currently Enrolled in the CRP Program (FNC 95-96). Kenneth Widener, Rt. 2, Box 96, Tekamah, NE 68061. Phone: (402) 377-2788.

Measuring the Rate of Benefit Accrual Due to Adoption of a Management-Intensive Grazing System on a North-Missouri Hill Farm (FNC 95-115). Martin Turner, Rt. 1, Box 158, LaPlata, MO 63549. Phone: (816) 332-7639.

Incorporating Holistic Resource Management (FNC 95-120). Larry and Judy Woodbury, 6295 Co. Rd. 23, McLeod, ND 58057. Phone: (701) 439-2605.

Stockpiling Pasture by Interseeding Annual Rye into Existing Pasture (FNC 95-122). Chuck Cornillie, 12947 Byron Road, Byron, MI 48418. Phone: (810) 266-4708.

Establishing Legumes in Cool Season Grass Pastures (FNC 95-123). Jon Immink, 57230, 703 Road, Endicott, NE 68350-3005. Phone: (402) 442-2234.

Evaluation of Kura Clover in Intensive Grazing Systems (FNC 95-124). David B. Kendall, 30602 Mill Creek Road, Bellevue, IA 52031. Phone: (319) 872-5652.

Tar Box Hollow Living Prairie (FNC 95-126). Larry, Rose and Monty Mason, RR 1, Box 8, Dixon, NE 68732. Phone: (402) 584-2337.

Converting Continuous Grazing to Managed Grazing (FNC 95-127). David Zahrt, RR 1, Box 53, Turin, IA 51059. Phone: (712) 353-6772.

Dairy

Comparing Various Grasses and Legumes for Dairy Cattle in a Rotational Grazing System (FNC 92-8). Kenneth and Judy King, 6003 East Eales Rd., Hutchinson, KS 67501. Phone: (316) 663-1470.

Evaluation of Forages in Rotational Grazing System--Dairy (FNC 92-10). Susan Polluk and William Andres, W 4146 200th Ave., Maiden Rock, WI 54750. Phone: (715) 594-3975.

Evaluating Rotational Grazing in the Development of Replacement Dairy Heifers (FNC 92-19). Kevin and Lisa Kirker, 15280 N. 60th Ave., Merrill, WI 54452-9109. Phone: (715) 536-2293.

Evaluating Productivity of Various Pasture Species by Utilizing Comsec Pasture, Gauge and Bulk Density Plates (FNC 93-33). Southeast Minnesota Grazier, c/o Dan French, Rt. 1, Box 152, Dodge Center, MN 55927. Phone: (507) 635-5619.

Developing Dairy Heifers on Pasture (FNC 93-40). Thomas Wrchota, 5200 O'Reilly Rd., Omro, WI 54963. Phone: (414) 685-6964.

Evaluating Forages in Rotational Grazing System--Dairy (FNC 93-43). Dale Kellenberger, 8717 Huttenlocker Rd., Munith MN 49259. Phone: (517) 596-2578.

Evaluating Different Forages in Rotational Grazing System (FNC 93-54). Kevin and Lisa Kirker, 15280 N. 60th Ave., Merrill, WI 54452-9109. Phone: (715) 536-2293.

Evaluating Various Forage Combinations in Rotational Grazing System (FNC 93-55). Myron and Marcie Herek, 3712 Custer Rd., Stevens Point, WI 54481. Phone: (715) 592-4104.

Evaluating Various Forage Combinations in a Rotational Grazing System (FNC 93-57). Kenneth and Judy King, 6003 East Eales Rd., Hutchinson. KS 67501. Phone: (316) 663-1470.

Incorporating Rotational Grazing into Conventional Dairy Enterprise (FNC 94-78). Randy Meyer, 36124 Co. 45 Boulevard, Lake City, MN 55041. Phone: (612) 345-4925.

Lane Construction, Maintaining High Quality/Quantity Pastures while Protecting the Environment and Maximizing Profits (FNC 95-97). Myron and Marcie Herek, 3712 Custer Road, Stevens Point, WI 54481. Phone: (715) 592-4104.

Rotational Grazing Management Internships (FNC 95-101). Alan Wood, Lakeland Agricultural Colnplex, W3929 Cty Rd. NN, Elkhorn, WI 53121. Phone: (414) 741-2252.

Hogs

Pasture Raised Poultry and Hogs (FNC 94-81). David Schafer and Alice Dobbs-Schafer, Edinburg Farms, Inc., Rt. 5, Box 33, Trenton, MO 64683. Phone: (816) 359-6545. (also noted under *Poultry*)

Evaluation of an Alternative Farming Concept--Strip Cropping and Pasture Raised Hogs (FNC 94-84). Tom Frantzen, 1155 Jasper Ave., New Hampton, IA 50659. Phone: (515) 364-6426.

Multi-phase Swedish Style Hog Structure with Attached Pastures (FNC 94-88). Nolan and Susan Jungclaus, 12540 210th Ave. SE, Lake Lillian, MN 56253. Phone: (612) 664-4843.

Winter Farrowing In a Low Input System (FNC 95-89). James Van Der Pol, 4075 110th Ave. NE, Kerkhoven, MN 56252. Phone: (612) 847-3432.

Comparing Finisher Pig Performance in a New Low Cost Canvas Shelter as Compared to Conventional Confinement Barns (FNC 95-110). Peg Bridenbaugh, 14282 Road 5-N, Pandora, OH 45877. Phone: (419) 384-3371.

Poultry

Pasture Raised Poultry and Hogs (FNC 94-81). David Shafer and Alice Dobbs, Edinburg Farms, Inc., Rt. 5, Box 33, Trenton, MO 64683. Phone: (816) 359-6545. (also noted under *Hogs*)

Pastured Poultry (Group Application) (FNC 95-94). David Bosle, RR 2, Box 206, Hastings, NE 68901. Phone: (402) 462-9424.

Free-Range Poultry Production & Marketing (FNC 95-118). Linda L. Lee, Rt. 2, Box 19, Creola, OH 45622. Phone: (614) 596-4379.

Sheep

Evaluation of Various New Zealand Forages in Sheep Production (FNC 92-6). David and Rosalie Sowatzke, 3156 Pierce, St. Croix Rd., Spring Valley, WI 54767. Phone: (715) 772-4501.

Intensive Rotational Grazing for Sheep (FNC 93-35). John and Linda Oswalt, 15168 S. 37th, Rt. 2, Vicksburg, MI 49097. Phone: (616) 778-3593.

CRP Acres--Pastures or Crop Production (FNC 93-51). Charles Cornille, Rt. 1, Box 57, Elbow Lake, MN 56531.

Alternative Use of CRP Acres--Grass Fat Lambs (FNC 94-71). Monty Mason, R.R. 1, Box 8, Dixon, NE 68732. Phone: (402) 584-2337.

Low Input Portable Sheep Dairying (FNC 94-76). Judith Moses, 972 192nd Ave., New Richmond, WI 54017. Phone: (715) 247-3128.

Suitability of Non-Native, Hardy, Forage-Adapted Mutton Sheep to North American Management Intensive Grazing System (FNC 95-100). Stephanie Mitcham, 2427, 220th Street, Tripoli, Iowa 50676. Phone: (319) 279-3270.

Improving Water Systems

Model Watering System for Rotational Grazing (FNC 93-36). Schafer Edinburg Farms, Inc., David Schafer and Alice Dobbs, Rt. 5, Box 33, Trenton, MO 64683. Phone: (816) 359-6545.

Livestock Watering Systems (FNC 94-61). Joe Golimbieski, 2392 S. M-76, Standish, MI 48658. Phone: (517) 654-3281.

Biological and Non-Chemical Pest Control

Non-Chemical Fly Control in Beef and Dairy Herds (FNC 92-11). Lowell Schroeder, Rt. 1, Box 55, Stanton, NE 68779. Phone: (402) 439-5398.

Using Poultry and New Scouting Techniques to Control Plum Curculio (FNC 92-15). Turkey Ridge Orchard, R.R. 2, Box 264CC, Gays Mills, WI 54631. Phone: (608) 735-4562.

Bio-Control of Colorado Potato Beetle Utilizing Poultry (FNC 93-56). Shelly and Quinn Cumberworth, 4126 Smith Rd., Dimondale, MI 48821. Phone: (517) 646-6722.

Growing Better Crops with IPM (FNC 94-58). Brian Churchill, Countryside Farm, 4075 Hwy 64 NW, Depauw, IN 47115. Phone: (812) 347-3486.

Protecting Beneficial Arthropods in Ohio Orchards (FNC 95-104). Bradley Phillips, 28 E. Main Street, Berlin Heights, OH 44814. Phone: (419) 588-2497.

Sustainable Plum Curculio Control in Apple Orchards (FNC 95-116). Dan Kelly, Rt. 2, Box 223-B, Canton, MO 63435. Phone (314) 655-4291.

Special Topics

Earthworms

Nightcrawlers as Natural Soil Conditioners (FNC 93-38). Robert VanHoveln, Rt. 2, Box 181, Milford, IL 60953. Phone: (815) 473-4445.

Education

Getting Started in Farming through Sustainable Agriculture (FNC 95-103). James Lumm, RR 3, Box 351, Concordia, MO 64020. Phone: (816) 463-2133.

The Development of an On-Farm Learning Center (FNC 95-109). Bob & JoAnn Fogg, 3043 Olds Road, Leslie, MI 49251. Phone: (517) 589-9290.

Quality of Life

Quality of Life: Comparisons in Various Dairy Operations (FNC 92-18). Ed Jeanquardt, 249 Cty. XC, Forestville, WI 54213 Phone: (414) 856-6889; and Kevin Kiehnau, 6265 Kiehnau Rd., Egg Harbor, WI 54209. Phone: (414) 743-5255.

Quality of Life Study--Comparing Conventional and Rotational Grazing Dairy Systems (FNC 93-44). Ed Jeanquardt, 249 Cty. XC, Forestville, WI 54213 Phone: (414) 856-6889; Kevin Kiehnau, 6265 Kiehnau Rd., Egg Harbor, WI 54209. Phone: (414) 743-5255; and Mark and Laura Gilbert, 3904 Brauer Rd., Sturgeon Bay, WI 54235.

Value-Added Enterprises

Producing and Processing Sweet Sorghum in the Upper Midwest (FNC 93-46). Richard Wittgreve, N9030 Little Elkhart Lake Rd., Elkhart Lake, WI 53020. Phone: (414) 876-2182.

Identifying Management Practices that Enhances the Probability of Producing Quality Durum Wheat for Pasta (FNC 95-128). Lawson Jones, Route 2, Box 90, Webster, ND 58382. Phone: (701) 395-4437.

Water Quality

Developing a Stewardship Plan for Water Quality (FNC 94-86). Tom Guthrie, 7301 Milo Road, Delton, MI 49046. Phone: (616) 623-2261.

Improving Ground and Surface Water Quality by Reducing Commercial Fertilizer Applications to Fields Receiving Livestock Manure Applications (FNC 95-125). Calvin Dyke, 9273 Garfield, Coopersville, MI 49404. Phone: (616) 837-6460.

Wetland/Riparian

Improving Native Wet Meadows (FNC 94-64). James Keller, HC73, Box 20, Newport, NE 68759. Phone: (402) 244-5448; Larry O'Kief, 527 N. Hall, Valentine, NE 69201, Phone: (402) 376-1883; and Mike Ramm, Rt. 1, Box 191A, Stuart, NE 68780, Phone: (402) 924-3140.

Riparian/Range Restoration (FNC 94-70). Jeff Mortenson, Box 993, Pierre, SD 57501-0993. Phone: (605) 224-4901.

Revegetation and Succession of Western Kansas Riparian Site (FNC 94-80). Carol Blocksome, Rt. 1, Box 120, Ransom, KS 67572. Phone: (913) 731-2763.

Winter-Barley

Barley Breeding by the Public (FNC 95-111). Walter J. Pickett, 529 S. Chestnut, Lindsborg, KS 67456. Phone: (913) 227-2800.

North Central Region

SARE/ACE Project Summaries: Research and Education Projects Active in 1995

Following are summaries, written by project coordinators, of North Central Region SARE projects active in 1995. "Matching" funds, indicated in many of the grants, are non-federal contributions used in support of the projects in addition to SARE funding. Funding listed may not be comprehensive in all cases; additional federal funds are omitted. Some projects are continued through extended grants. These are indicated by a period and the number one following the project number, as in "LNC 92-47.1."

Regional Inventory and Assessment Project and SARE/ACE Quality of Life (QOL) Proposals

Project Number:
LNC 95-93

Project Coordinator:
Cornelia Flora
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Ames, IA 50011-1070
Phone: 515-294-8321
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Michael M. Bell
Department of Sociology
Iowa State University

Funding:
SARE: $146,204

Duration:
September 1995-August 1997

Keywords:
Quality of Life

Abstract

Quality of Life, Socio-Cultural Factors, and the Transition to Sustainable Agriculture: A Study of Practical Farmers of Iowa (PFI). This project is a participatory, qualitative study of the sociocultural factors that foster acceptance of sustainable agricultural practices. Emphasis will be on the role of farmers' and farm families' concepts of quality of life and sustainability, and on the role of a sustainable farming organization in the development of these concepts. In essence, this project is a participatory community study of Practical Farmers of Iowa (PFI), looking at this organization as a kind of community. Through the use of focus groups, participant observation, interviews with 60 farm households, and intensive case studies of 15 farm households, the project will contribute both to social scientific understanding and to building effective sustainable farming organizations.

In order to assess the role of concepts of quality of life and sustainability, and the role of a sustainable farming organization in the development of these concepts, comparisons have to be made with farm operations across the conventional-sustainable continuum of practices, as well as with farms with different degrees of involvement in PFI. Although it is a sustainable agriculture group, PFI contains farmers with a range of farm practices, and our sample will reflect that. As well, we will also sample farmers who are no longer members of PFI and farmers who have participated in PFI activities such as field days but have chosen not to join. (The names and addresses of these farmers are available from old PFI membership lists and attendance sheets passed out at PFI events.) We will also include a sample of non-PFI farm neighbors of PFI farm members. In all of these cases, every effort will be made to approach participating farms through informal networks so as to increase research rapport and commitment to the project.

Quality of Life and Farming Practices.

The goal of this part of the project is to develop measures that will help assess the degree to which different farming practices effect quality of life. The one part of the project is qualitative, will be expanded to other groups to help farmers assess the current interaction between quality of life and farming practices. The broader project will develop a study based on survey research where different groups of farmers will relate their different farming practices to measures of quality of life. In this part of the study, we will work with a variety of farm groups including the farm improvement associations that are forming in a variety of counties across the region as well as work with existing researchers within the region to insert the questions in on-going farmer studies.

By the end of the second year, we should be able to detail further which shifts in farming practices have negative or positive impacts on a variety of dimensions of quality of life that different groups of farmers deem important.

Sustainable Agriculture Quality of Life Questionnaire.
The purpose of this study is the development and validation of the Sustainable Quality of Life Questionnaire. Project objectives are to construct a questionnaire to measure the quality of life of farmers, to validate this instrument, and to disseminate the results of the project. The instrument will be developed using the Foa and Foa Exchange Resource Model for quality of life. Questions in Dr. Cornelia Butler Flora's quality of life survey will be fit to the original model with the addition of two additional resources found to be important for farmers. These exchange resources are SPIRITUALITY and HEALTH. The Practical Farmers of Iowa (PFI) will serve as one group of participants for this study. A random sample of 1,000 farm couples from membership lists obtained from sustainable organizations in the Midwest will be sent the Sustainable Quality of Life Questionnaire, the Beck Depression Scale, Evans and Cope's Quality of Life Questionnaire and a demographics information sheet. This instrument could be used for research, and at a more individual level for monitoring and improving family life satisfaction. Expected results of this project will provide new information about how farmers view their own life quality. This information can be used in many ways to understand the intricate combination of factors that contribute to life quality for sustainable farmers.

Women in Sustainable Agriculture Talk about Quality of Life.
This project intends to highlight the meaning of and concerns about "quality of life" among women engaged in sustainable agriculture. First, two years will be spent on research and the production of a videotape. By the end of the two-year grant period five workshops will offer the videotape and questions for discussion to Extension agents in every state in the North Central region. The first year, three workshops in stern South Dakota and three in Minnesota will be videotaped and conducted. The second year, three workshops in Wisconsin and three in southern Michigan and northern Ohio will be videotaped. The locales of the four workshop were chosen to make sure a variety of conventional farming practices were represented: ranching in western South Dakota, row crops in Minnesota, dairy farms in Wisconsin and fruit/vegetable farms in southern Michigan and northern Ohio. An equal numbers of women who live and work on sustainable farms and women who live and/or work on conventional farms, will be recruited as workshop participants. This will enhance the comparativeness of our results. Third, we will work with Professor Delworth and Ms. Striegel. They, too, plan to increase the area covered by their survey; their quantitative data and our qualitative data will be comparable and thus the validity of each will be enhanced. Fourth, we will ask some questions in our workshops suggested by Peggy Barlett's study of Georgia farmers' definitions of quality of life (as reported in *American Dreams. Rural Realities*). Again, this will allow for comparison over a larger geographic area and will, thus, increase the representativeness of our research results.

Obstacles to Market Access for Family Farm Hog Producers

Project Number:
LNC 95-92

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Funding:
SARE: $50,180
Match: $15,750

Duration:
September 1995 - August 1997

Keywords:
Quality of Life
Livestock Production
Marketing

Abstract
Independent farmers in the North Central Region are successfully developing sustainable, lowcost production practices in whole-farm systems that integrate crops, forage, and hogs. However, changes in the structure of agriculture threaten the economic viability of these farmers. Large-scale hog-confinement operations linked to large packing companies exert market power that limits market access by independent, small- and moderate-scale producers. To increase public understanding of this issue, Land Stewardship Project (LSP), in collaboration with Farmers' Legal Action Group (FLAG), Dr. John Helmuth of Iowa State University, PrairieFire Rural Action (PrairieFire) in Iowa, and Dakota Rural Action (DRA) in South Dakota proposes a four-part research and education project.

Objectives
Document the problems experienced by small- to moderate-sized farmers in finding competitively priced markets for their hogs. LSP, PrairieFire, and DRA will gather first-hand narrative accounts from farmers who have been affected by changes occurring in the structure of the hog industry. The person principally responsible for coordinating this effort will be Mark Schultz, Director of LSP's Policy Program and an organizer with nearly ten years of experience working with farmers and rural communities.

Assess the economic impact of packer concentration and vertical coordination on family farm hog production. Dr. John Helmuth, Director of International Programs, Center for Agricultural and Rural Development, Department of Economics at Iowa State University, will review findings of previously published studies on the economic impacts of packer concentration and vertical coordination on livestock producers. Included in this analysis will be a discussion of the packer concentration and vertical integration studies due to be issued by the Packers and Stockyards Division of USDA in the fall of 1995.

Complete a legal analysis of whether packer concentration levels and methods of vertical integration comply with the Packers and Stockyards Act and its implementing regulations. FLAG will complete this analysis.

Sarah Vogel, North Dakota Commissioner of Agriculture and an attorney with years of experience in agricultural law, will review the legal analysis and provide report material for the project report on the implications of the project's findings on state departments of agriculture that regulate the hog industry.

Publish and disseminate findings of the three studies and stimulate discussion leading to new strategies to secure market access for sustainable hog producers. The person principally responsible for publication and dissemination of the findings will be Dana Jackson, associate director of Land Stewardship Project, who has many years of experience in communications, publications, and outreach programs.

This project will examine one of the most critical issues confronting sustainable agriculture today: fair competition and access to markets in the hog industry, and it will explore how enforcement or reform of the Packers and Stockyards Act could affect sustainable agriculture. Results of the project will be a better understanding of structural changes that are needed to provide more opportunities for sustainable agriculture.

Methods

Develop and distribute a questionnaire and conduct interviews to elicit information from family farm livestock producers about their experiences with availability of markets and changes in pricing structures in their communities.

Gather reports, journal and news articles, and other sources of information documenting occurrences in the hog industry affecting market access and pricing and production systems.

Hold discussions with the economists and lawyers who will be performing the economic review and the legal analysis for this project, to ensure that they address whether the economic studies cover the types of problems raised by family farm livestock producers and whether such problems may be addressed through current law and policy.

Recruit farm organizations in states throughout the North Central Region to gather information from their constituents and contacts about their experiences with access to markets and competitive prices for their hogs, and submit the information to LSP for the report (see letters of agreement from Illinois Stewardship Alliance and Iowa Citizens for Community Improvement).

To review and analyze the economic studies of packer concentration, captive supplies, and vertical coordination in the red meat industry, with an emphasis on the hog sector. The report will concentrate on the findings of these studies and their implications for sustainable farming and livestock production, including how the changing structure and practices of the packing industry affect market access and prices paid to family farm livestock producers, and the degree to which they contribute to the growing trend of fewer independent hog farmers, and more large-scale confinement operations that use high input, industrialized practices. Specific packer practices that may adversely affect independent producers will be identified and examined.

Determine whether current packer concentration of market share and methods of vertical integration conform with the Packers and Stockyards Act and its implementing regulations. The legal analysis will also include specific language for amendments to the statute and implementing regulations to cover packer practices that the economic studies have shown to be adversely affecting market access or prices for livestock producers that may not be addressed by current law.

Publish findings of the studies completed under objectives 1 through 3, disseminate the report widely, and create discussion among researchers, farmers, the legal profession, sustainable farming organizations, and policy makers that leads to new strategies for the success of livestock production within sustainable agriculture.

Integrating Quality of Life, Economic and Environmental Issues: Agroecosystem Analysis of Amish Farming

Project Number:
LNC 95-91

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Participants:
Three Amish Families
Holmes County, Ohio

Funding:
SARE: $40,800
Match: $26,400

Duration:
September 1995 - August 1997

Keyword:
Quality of Life

Abstract
The Old Order Amish are one model of agricultural and social sustainability that may teach some fundamental principles of sustainability. The data generated by this project could help our target audience (farm families, agricultural scientists and other academicians, students, civic leaders and consumers): 1) see that more holistic and sustainable world views than ours can make good economic sense for farm families and rural communities and produce a high quality of life; 2) to stimulate examination and discussion of principles of sustainability and 3) encourage people to think about how to apply these principles on their farms and in their own communities. A more in-depth quantitative work on Amish agriculture and community will strengthen and sharpen this dialogue and stimulate more people involved in sustainable agriculture to think about and develop their own alternatives.

Objectives
Determine quality of life and community values for three case study Amish families.

Analyze the economic efficiency of Amish agriculture with particular emphasis on quantifying the economic benefits of community.

Develop whole farm nutrient budgets of case study Amish farms to evaluate nutrient cycling efficiency of Amish agriculture.

Facilitate discussion on how what we learn from the Amish can help mainstream farm families better balance quality of life, economic and environmental goals and become more sustainable.

Method
Three Amish families in Holmes County, Ohio have agreed to work with us on this project. They will not only provide information and access to their farms for field sampling, but also contribute conceptually. We will use a system used in Holistic Resource Management classes to address the first objective. For the first objective we will use a combination of FINPAK, Planetor, Holistic Resource Management financial planning and qualitative aspects of the Wisconsin Whole Farm Economic Model. Using Planetor will help us directly link our economic and environmental objectives. For the nutrient budgets we will use a spreadsheet model developed by Lanyon and Schlauder at Pennsylvania State University which will allow us to calculate individual field, livestock and whole farm nutrient balances for N, P, K and Ca. Ben Stinner will help develop the nutrient budgets. Deborah Stinner will oversee the entire project and be responsible for disseminating the information through presentations and publications.

We expect to find that the Amish are doing very well economically for a number of reasons which should lead to stimulating discussions on fundamental issues of sustainability. Results of the nutrient studies should be very interesting also, as the farms we will be working on have a much longer history (40 -75 years) of sustainable management of any farm we have studied.

Outreach

In addition to the one-on-one interactions with mainstream farmers participating with us on other SARE research, HRM participants, and field days described above, findings from these objectives will be disseminated in the numerous presentations to colleges and universities, farmer groups and civic groups. We will publish articles in the Innovative Farmers of Ohio (IFO) newsletter and present a poster session at the annual IFO meetings. Results of our work will be offered to established writers of lay literature for quick release. There is a great general interest in the Amish, so it also will be published in the scholarly literature for the natural and social science audience.

Weed Control for More Sustainable Soybean Production

Project Number:
LNC 95-90

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Funding:
SARE: $80,000
ACE: $7,262
Match: $41,820

Duration:
September 1995 - August 1997

Keywords:
Weed Control
Biocontrol
Soybeans
Weed Competition

Abstract

The goal of this project is reduced environmental impact and improved effectiveness of weed control for reduced-tillage and organic soybean production, thus promoting adoption of these more-sustainable systems. We will conduct on-farm efficacy trials of an integrated system of biological weed control for these systems. This system employs two means of biological control: highly weed-competitive soybean varieties, and a naturally occurring bacterium *(Pseudomonas syringae pv tagetis*) that causes severe disease in a range of composite-family weeds (e.g.. Canada thistle, wild sunflower, common ragweed). Our preliminary work has established that each of these biocontrol agents has moderate to good weed control effectiveness used individually. Used together, we expect the weed-competitive soybeans to provide initial suppression of weed seedlings; the bacterial agent is then expected sharply reduce survival, growth and seed production of these weakened weed seedlings. We expect the integrated system to be of particular value for control of certain composite-family weeds, such as Canada thistle and common ragweed, for which current control methods are expensive and poorly effective. Specifically, neither the herbicide-intensive weed management used in reduced-tillage soybeans nor the cultivation-intensive management used in organic soybeans provides effective and economic control of these species. Equally important, both herbicide- and cultivation-intensive weed control cause serious pollution of ground and surface waters. Because our integrated biocontrol system is specifically active against these problematic composite weed species, we expect its adoption will improve effectiveness and reduce monetary and environmental costs of weed control in reduced-tillage and organic soybean production.

Our on-farm efficacy trials will be conducted cooperatively by a group composed of four farmers and eight university personnel on two reduced-tillage farms and two organic farms. On each farm, we will conduct replicated large-plot experiments in which we measure the individual weed control value of each biological control agent, and test for synergy between the agents in their effects on weeds. We will compare soybean yield, yield loss to weeds, weed biomass and seed production, and net economic return of the integrated biocontrol system to corresponding values in conventional herbicide- and cultivation-intensive weed control systems. Farmers and university workers will collaborate to plan and establish experiments at each farm site, although university personnel will have primary responsibility for day-to-day management of experiments.

Our entire research group will meet periodically to review results, plan additional work, and prepare outreach presentations and publications.

In outreach, we will present findings and receive feedback in workshops, meetings and publications organized by each of five major nonprofit organizations comprising the Sustainers Coalition of the Minnesota Institute of Sustainable Agriculture (MISA). The co-principal investigator (Wyse) will coordinate outreach collaborations with these organizations through his role as MISA executive director.

In summary, we will test and refine effectiveness of an important weed control method for more sustainable soybean production, dialogue about our findings with interested persons through the outreach infrastructure of the MISA Sustainers' Coalition, and initiate a farmer-university cooperative research approach to develop sustainable weed control methods for the North Central region. Thus, we expect our work to meaningfully address ACE priority concerns including non-chemical pest management, pesticide use reduction and surface and groundwater protection.

Objectives

In an organic production system, compare weed control using competitive soybean varieties and bacterial biocontrol to current cultivation- and labor-intensive methods.

In a no-till production system, compare weed control using competitive varieties, bacterial biocontrol, and reduced herbicide rates to current herbicide-intensive methods.

Collaborate with member organizations of the Sustainers' Coalition of the Minnesota Institution for Sustainable Agriculture in presentations, discussions and evaluations of research findings at summer field days and winter workshops.

Initiate a broad-based cooperative research approach to develop integrated cultural and biological weed management, in order to reduce sediment and herbicide pollution associated with weed control, and support development of new sustainable farming systems for the North Central region.

Approach

We will work on two certified-organic farms producing soybeans in central Minnesota (Fernholtz and Murphy farms). On each, we will conduct a replicated experiment in which we assess weed control effects of competitive soybeans and biocontrol. Farmers and university personnel will cooperate to establish plots, collect data and evaluate results and applicability of findings. Phosphorous and potassium will be applied at recommended rates as necessary; weather data will be collected at or near both sites. We will use adapted (Groups 0 and I) commercial soybean varieties identified as more- and less-competitive in preliminary work, grown in narrow (2 cm) rows to promote weed suppression. Using large (40 m by 30 m) plots, highly-competitive (Kato and Lambert) and less-competitive (Kasota and Evans) varieties will be grown with each of two weed control treatments. The first treatment represents the cultivation-intensive weed management system presently used for organic soybean production in these operations. In this system, a cover crop is incorporated with several discing operations, followed by two rotary hoeings and two row cultivations. In the second, reduced-cultivation treatment, a single spray application of the biocontrol agent PST will replace one rotary hoeing and one row cultivation.

Impacts of Intensive Rotational Grazing on Stream Ecology and Water Quality

Project Number:
LNC 95-89
ANC 95-25

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Department of Natural Resources

Funding:
SARE: $43,488
ACE: $40,488
Match: $64,061

Duration:
September 1995 - August 1997

Keywords:
Livestock Production
Soil/Water

Abstract
Rotationally grazed shoreline areas may mimic vegetative filter strips and effectively act to reduce and filter runoff from adjacent land, while allowing the land owner to retain use of the land. Rotational grazing encourages grass growth and development of healthy sod. Application of rotational grazing to shoreline areas may help stabilize stream banks and could be used to maintain and improve riparian habitats.

We propose to explore rotational grazing management techniques which are likely to maintain or improve shoreline integrity and reduce water pollution while allowing use of riparian areas by the farmer. The objectives of this project are: 1) to evaluate rotational grazing management within riparian areas as an alternative to ungrazed vegetative filter strips or unmanaged continuous pasturing of livestock in riparian areas, 2) to develop, in partnership with grazers, guidelines for environmentally sound use of these areas, 3) to convey the guidelines developed to livestock farmers through field days, publications, and other educational media. The study will focus on four general areas of investigation: 1) assessment of in-stream biotic integrity and habitat, 2) assessment of stream bank stability, 3) riparian and stream bank vegetation characterization and sampling, and 4) agronomic evaluation.

This project brings together many of the stakeholders involved in the debate over the use of agricultural shorelines and their role in non-point pollution control. Participants include livestock farmers, researchers from the University of Wisconsin College of Agriculture and the Wisconsin Department of Natural Resources (WDNR) Bureau of Fisheries, Water Resources and Wildlife Research, and WDNR and Wisconsin Department of Agriculture, Trade, and Consumer Protection policy makers. The study will make use of the framework provided by the WDNR Priority Watershed Program, which has identified watersheds having serious non-point pollution problems and involves working with land-owners within those watersheds to improve land and shoreline management for improved water quality.

Continuously grazed and ungrazed study areas will be selected on farms already in the program that have been monitored for the past several years. Rotationally grazed farms will be brought into the program for this study and the techniques developed with the help of these graziers will be incorporated into Priority Watershed goals.

Development of guidelines for appropriate management of riparian areas will encourage livestock farmers who face regulation of waste management to consider rotational grazing as an economically and environmentally sustainable alternative to their current system. Rotational graziers are confident that they can manage riparian areas on their farms to preserve water quality and aquatic habitats. It is likely that they can influence their neighbors more effectively than agency land use regulations. This study will combine the efforts of the environmental and farming communities in finding profitable, sustainable approaches to managing agricultural shorelines.

Objectives

To evaluate rotational grazing management for shore land corridors and compare with continuously grazed and ungrazed riparian areas.

To develop, in partnership with graziers, guidelines for environmentally sound use of these areas.

To convey the guidelines developed to livestock farmers and extension, natural resources and regulatory agency personnel through field days, publications, and other educational media.

Approach

The goals of this study are to compare rotationally grazed riparian areas with alternative management strategies in terms of environmental and agronomic effects, and to determine the parameters required for environmentally sound use of shoreline areas in rotational grazing systems. This project is one phase of a broader study plan to examine overall pasture system effects on water quality and aquatic habitat. In this project we will focus on investigating how livestock grazing affects stream bank stability, biotic integrity, and aquatic habitat of grazed riparian areas.

Of equal importance to riparian ecological health is surface water quality and runoff from adjacent land. A second phase of the project will investigate runoff water quality, its effects on the stream ecosystem, and the ability of various shoreline grazing management practices to filter runoff and protect riparian habitats. Additional funds from other sources will be sought for this component of the study and for a wildlife survey component. For the wildlife survey component, use of riparian habitat by wildlife groups such as game and non-game birds, amphibians, or small mammals will be monitored. All phases of the multi-year study will be integrated to develop a decision-making aid for land-owners and will be incorporated into WDNR Priority Watershed activities and Wisconsin Department of Agriculture, Trade, and Consumer Protection (WDATCP) shore land management guidelines.

Training and Transitioning New Farmers: A Practical Experiment in Farmer Self-Development and Institutional Re-Invention

Project Number:
LNC 95-88

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The Agricultural Technology
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The Farm and Industry
Short Course
UW-Extension

The Wisconsin Technical
College System Grass Works, Inc.

Bickford Farms
Ridgeway, WI

Warren Parker
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New Zealand

Funding:
SARE: $85,800
Match: $147,250

Duration:
September 1995 - August 1997

Keywords:
Beginning Farmers
Grass-based Dairying

Abstract
This project addresses the serious decline over the past several decades in the rate of entry of new dairy farmers in Wisconsin and the North Central region. Meanwhile, an increasing number of dairy farmers are adopting various forms of rotational grazing to address issues of profitability, life style, and environmental stewardship. Grass-based dairying may offer an effective entry vehicle for beginning farmers because of its potentially low capital and startup requirements. Additionally, veteran graziers appear willing to act as mentors and sponsors for young farmers interested in grass-based dairying. This project proposes to link institutional resources with these veteran farmers to train and transition young families into sustainable farming enterprises. The project seeks to: 1) investigate and adapt New Zealand beginning farmer programs that have successfully prepared and placed new dairy farmers for the past 30 years; 2) develop and evaluate a new "School for Beginning Dairy Farmers" at the University of Wisconsin-Madison; and 3) advise and monitor case examples of veteran graziers who are mentoring and sponsoring the entry of dairy farm families.

Objectives
Investigate and evaluate for adaptation in Wisconsin and other states in the region New Zealand's programs for the education and entry of new dairy farmers.

Develop and evaluate a new pilot "School for Beginning Dairy Farmers" in Wisconsin.

Advise and monitor case examples of veteran graziers who are sponsoring and mentoring the entry of new farm families into grass-based dairying.

Outreach
Advertising the pilot School and recruiting high caliber students will be the critical initial form of outreach to the primary audience. Funds to target potential candidates for the pilot project are requested to augment the Short Course's regular publicity and recruiting efforts. In addition, information on the new School will be distributed through several of the state's excellent agricultural newspapers, the grazer networks coordinated through Grass Works, Inc., the Wisconsin Farm Entry/Exit Coalition, as well as regular outreach mechanisms of the UW Extension and the Wisconsin Technical College System. Institutional administrators will be regularly updated on the pilot School. Final reports on the project's findings will take the forms of academic and extension publications, news releases, and reports by project participants at field days, meetings and both academic and practitioner conferences.

Fresh to Processed: Adding Value for Specialty Markets

Project Number:
LNC 95-87

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Missouri Department of Agriculture
Domestic Marketing

Missouri Agricultural Statistics Service

Persimmon Hill Farm

Funding:
SARE: $67,000
Match: $26,000

Duration:
September 1995 - August 1997

Keywords:
Value-Added Processing
Education/Networking/Extension

Abstract
In each case, from totally different perspectives, the news that sustainable agriculture is a viable alternative to chemically-intensive farming has caused an increase in the number of farmers seeking information on sustainable growing and direct marketing techniques. Consumer demand for fresher, more natural and more nutritive foods reinforces the farmers need for more information.

There is also a trend among consumers that carries both environmental and economic impact: to purchase food made from natural and/or organic ingredients, without additives such as dyes and preservatives, and free of pesticides. And there are a growing number of farmers willing to respond to the consumer's desire for these products. Some farmers are already producing value-added products, marketing them through a variety of channels, including mail order, farmers market, food shows and retail outlets.

Retail outlets in particular offer farmers advanced opportunities to reach consumers who would not necessarily come into frequent contact with their products, offering advancement for their farms' economic viability and promoting the local economic multiplier.

Missouri's booming tourist trade offers the farmer a consumer-base "ripe" for farm-produced value-added products. These consumers are looking for souvenirs to take home as gifts, or as memories of their trip. They want goods produced in the area they are visiting, and consumable items are favored in many instances.

Many gift stores have already realized the profitability of adding food items to their product lines. The retailers want products from Missouri, according to Jim Anderson of Missouri Department of Agriculture, Domestic Marketing Division. At this time, however, no marketing studies of gift shop or the tourist trade have been conducted.

This grant would help fund the research that has not been done which would identify particular retailers with an interest in presenting locally produced value-added products, as well as identifying types of outlets that could be approached to carry farm-produced food items.

Objectives
Examine specialty markets in Missouri for feasibility of providing private and/or farm label value-added agricultural [farm produced] products.

Determine minimum crop yields and identify quality of fresh produce required to successfully participate in value-added processing at the specialty market level based on market study.

Develop curriculum for presentation to farmers based on information from market study, calculations of yields needed for processing, and additional information including, but not limited to, product development, packaging, merchandising, delivery systems and cost analysis.

Present first seminar to farmers at University of Missouri Agriculture Science Week.

Present workshops throughout Missouri in the eight regions designated by University of Missouri Extension Service.

Develop business plan for a kitchen incubator where farmers can process their own value-added products in the mid-Missouri area.

Develop business plan for a marketing cooperative.

Reduced Chemical Inputs in Alternative Potato Farming Systems

Project Number:
LNC 95-86

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Cooperative Extension Service

USDA-ARS Dairy Forage Research Center

Funding:
SARE: $64,800
Match: $61,725

Duration:
September, 1995-August, 1997

Keywords:
Crop Production
IPM

Abstract
More chemical inputs are used for potato production than for any other crop in the North Central United States. Multiple applications of fungicides, insecticides and herbicides are made. In addition, soil fumigation is a common practice. A high level of fertilizers are also applied.

In Wisconsin, dairy farms epitomize the image of sustainable family farming. In truth, such farms are being lost rapidly in part because the family dairy farm has specialized in the production of a single commodity -- milk. Crops grown on most dairy farms have primary value only as on-farm inputs for milk production. Corn and forage prices preclude these crops as significant sources of cash receipts. As the price of milk has stagnated and costs have gone up, economic hard times have resulted. A solution for some may be diversification to eliminate total dependence on the milk check. A crop with high cash value that could make use of on farm inputs itself while providing on farm inputs to the dairy subsystem would be ideal. The potato subsystem and the dairy subsystem on a diversified farm have great potential to complement each other.

In a previous project funded by the NCR-IPM program we reduced pesticide inputs 80-90% and nitrogen fertilizer 50% (100 lbs N/acre) by utilizing mixed crop-livestock farming systems dispersed away from the concentrated potato production area to avoid key pests. We hypothesize that pests can continue to be managed at levels below economic injury by using several alternative practices that are particularly adapted to mixed crop-livestock systems. In these systems the acreage of potatoes will remain small compared to current potato production systems resulting in fewer pests. Because pesticides are infrequently used, high populations of natural enemies are present. One dairy farmer we worked with last year netted $800/acre on 20 acres of potatoes. The year before that, a farmer we worked with increased milk production 5 lbs/cow/day by feeding cull potatoes in his TMR. We now want to test the hypothesis that removing potato foliage at the end of the season instead of vine killing with herbicides will reduce inoculum of Verticillium (cause of potato early dying) and *Alternaria solani* (cause of early blight).

We hypothesize that harvested potato vines and cull potatoes can be made into silage and fed to ruminant livestock in a TMR system. Manure from the livestock system can be used as fertilizer. By using 30" row spacing instead of 36" spacing we will improve competition of potatoes against weeds and have compatibility with tractors used on corn. Several farmers are anxious to work with us to test these ideas.

Two dairy farmers who are near each other have even purchased potato equipment together for $35,000 and are planning to grow 40 acres.

Objectives
To demonstrate the desirability of alternative sustainable farming systems that include potato as a significant component. The desirability derives from greatly reduced chemical pesticide and fertilizer inputs to the potato subsystem as well as supplemental feed inputs to the dairy subsystem, along with high cash value.

Results
The feasibility of growing potatoes on a mixed crop/livestock farm (e.g. Wisconsin dairy farms) has been demonstrated in field trials over the past three years in a project funded by the North central regional IPM program. That project was motivated by the observation that potato production is highly concentrated in specific areas. To what extent is the concentration of acreage on short rotations responsible for the concentration of pest problems? The central hypothesis of the IPM project was that reducing the concentration of acreage grown to potatoes in a particular location would reduce the key pest problems.

The IPM project, initiated in 1991, produced striking results. Yields from plots established on farms outside the potato growing region were comparable to within the central sands when irrigation or rainfall provided adequate soil moisture. The potatoes grown on farms inside and outside the Wisconsin central sands area were monitored for key pest problems. In 1991 the average number of pesticide applications per field inside the potato production area was 15 while we averaged only 2.5 applications outside. The table on the next page indicates the pesticide usage results for 1991-1993. Even less pesticide was used in 1992 outside the traditional growing area and yields in 1992 were 100 cwt/acre above the state average.

Nitrogen requirements were reduced by 50 lbs (100 lbs actual N/acre) or more when potatoes followed alfalfa. In 1993 we compared fields inside the potato production area which had never been in potatoes with our outside locations. Several of our outside locations had now had potatoes in the vicinity for one or more years. For example we had potatoes on different portions of the Huit farm all three years. Because the acreage was small and we never used adjacent fields we still used few chemical pesticides in 1993.

A meeting of potato growers and farmers was arranged by extension personnel with the IPM researchers and 2 agricultural economists. Potato growers as well as dairy farmers were reluctant to respond positively to the idea of extending rotations and reducing chemical inputs. There were a number of issues raised on all sides. The IPM plots were between 0.5-1.0 acres in size and had not been observed first hand by the potato growers. Potato growers wanted to see production first hand on a larger scale before they committed themselves to a financial arrangement involving the costs and time involved in moving equipment to new locations. Farmers were concerned for their land and whether increased erosion would result. Would weeds be adequately controlled when potatoes were grown? They were also concerned about being treated fairly by "rich potato growers."

Ecological Principles of Habitat Management for Weed and Insect Biological Control

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LNC 95-85

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Funding:
SARE: $94,923
Match: $23,386

Duration:
September 1995 - August 1997

Keywords:
Biological Controls
Landscape Ecology
Habitat Management

Abstract

The following proposal seeks to develop whole-farm approaches to weed and insect management that rely primarily on biological processes. While weeds are a major focus of the proposal, the natural enemies of insect pests will also be studied. Some of the most important natural enemies of weeds are insects, and practices to enhance those beneficial to weed management can also be used to enhance insects that attack pest insects. Because producers must have integrated systems to mange both of these pests, these biologically based management systems for weeds and insects will be studied at the same time using a whole-farm approach.

Biological solutions to specific pest problems will vary from farm to farm. Our goal is to understand the ecological processes which underlie the abundance and diversity of natural enemies. We also seek to determine and manage which processes influence the ability of natural enemies to regulate weed and insect populations in field crop farming systems. Communicating these principles to producers will allow them to incorporate appropriate biological weed and insect management practices into their particular farming system. This will result in more rapid implementation as farmers develop ownership of specific practices and form the critical first link in the transfer of information to other producers.

Understanding how landscape structure influences the abundance, diversity and effectiveness of predators and parasites in agricultural systems was the focus of an earlier LISA grant (LWF62-016-02942). Our research has shown that natural enemies have great potential for pest suppression. For example, 87 percent of weed seeds placed on the soil surface were removed from native successional plots by seed predators in 6 days. Specific habitats in landscapes are critical to the survival of natural enemies. In our research a corn borer parasite (*Arbors terebrans*) required access to habitats outside of corn fields for food (plant nectar) and escape from high temperatures. Overall landscape complexity may be critical to the effectiveness of these natural enemies. Our research has also documented three times greater parasitism of the true army worm in a complex vs. simple agricultural landscape.

Integrating the ecological concepts developed at the within-field, between-field and landscape levels into a whole-farm approach to alternative pest management systems is the goal of our proposed research and education project. We have developed our initial findings into a set of guidelines. We propose to test these guidelines by implementing a system designed for the Fogg Farm and evaluate its impact on weed seed abundance and subsequent weed communities.

We also propose to further develop our understanding of the influence of landscape structure and management on weed and insect natural enemies.

Objectives

On-Farm Application of Habitat Management Principles for Weed Biological Control:
On the Fogg Farm (organic field crop production), weed management relies on spring mold board tillage for control of emerged weeds, followed by cultivation for within season control. Over seeded cover crops provide additional winter and spring weed suppression. These practices do not take advantage of potentially important seed predation following seed rain. In light of our previous results, R. Fogg in conjunction with University collaborators has developed a habitat management plan for weed seed predators that will be implemented and evaluated. Headlands will be managed as a semi-permanent over wintering habitat for vertebrate and invertebrate seed predators. Within-field predator refuge strips will provide over wintering and movement corridors. Refuge strips will consist of a grass-legume mixture established with an oat nurse crop. Establishment will be initiated in spring of 1995. Quantitative evaluation of the impact of these practices on weed and natural enemy communities will provide a scientific assessment of the biological viability of these practices. Qualitative evaluation (in large part by the Fugues) of the success of this approach to integrating research and education will be used to determine if this methodology should be more widely applied in sustainable agriculture.

Refinement of Ecological Principles of Habitat Management for Weed Biological Control:
Weed seed rain and subsequent loss of seeds to seed predators influences the dynamics of the weed seed bank and emergent weed communities in cropping systems. In our previous research both vertebrates (birds and rodents) and invertebrates (insects, other arthropods) significantly reduced weed seed abundance following seed rain. Vertebrates removed up to 40% of the weed seeds (foxtail and velvet leaf) exposed on the soil surface in the winter. Both vertebrates and insects removed additional seeds (36 percent of lambs quarters, 66 percent of pig weed) in the spring following planting. Removal rates were similar at distances of 5 and 100 meters from a field edge and increased with increasing crop residue cover. To maximize weed seed predation we must understand how within-field and landscape level vegetation influence seed predation and the resulting weed community. Elucidation of these ecological principles will then allow their communication to producers who can adapt practices on their farms to manage seed predation to their benefit.

Refinement of Ecological Principles of Habitat Management for Insect Biological Control:
In our previous research, habitats adjacent to crop fields were show to be critical for the success of the European corn borer parasite, *Eriborus terebrans*. In other cases, the matrix of non-crop habitats in the agricultural landscape and not simply field edges was shown to significantly influence parasite effectiveness (Marino and Landis, in press). To design farming systems to take full advantage of potential biological controls, farmers need to know what combination of field/farm and landscape characteristics favor communities of natural enemies. The proposed experiments will allow us to distinguish between the effect of overall landscape structure vs. the impact of specific landscape elements on a community of insect parasites. The results will indicate if the approach of retaining or adding habitats that provide generalized resources for natural enemies is a viable means of managing pests.

FFA Participation in On-Farm Demonstrations of New Tools for Optimizing Use of Animal Manures in Crop Production

Project Number:
LNC 95-84

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Funding:
SARE: $90,000
Match: $22,500

Duration:
September 1995 - August 1997

Keywords:
Education/Networking/Extension
FFA

Abstract
The primary barrier to acceptance of the new tests by farmers in Iowa is the strong mind set that manure has little or no value because commercial fertilizers are relatively inexpensive and more reliable. Farmers who manage both crop and livestock production units would benefit most by using the test, but they are difficult to reach because only a small percentage of their attention can focus on optimizing N management.

New soil tests enable site-specific management that dramatically reduces unnecessary inputs of commercial fertilizers, reduces costs of crop production, reduces the potential for environmental degradation, increases the competitiveness of agriculture, and helps keep dollars in rural communities. The program actively involves farm youth, our most valuable resource, for enhancing the viability of family farms, in experiencing and promoting the benefits of improved management practices.

The overall objective of this project is to introduce Future Farmers of America to agricultural research and help both present and future farmers recognize the great economic and environmental benefits of using new soil and tissue tests that enable site-specific management of animal manures to supply nutrients needed for crop production. Following are specific objectives with a brief statement of the rationale for each.

Objectives
To introduce Future Farmers of America to agricultural research. There is an urgent need to get bright young people with farm backgrounds more interested in careers in developing and promoting sustainable agricultural systems.

To help future farmers discover the value of good management. A recent three-year research program funded by the Leopold Center for Sustainable Agriculture evaluated the new tests in more than 100 on-farm trials. The results clearly demonstrate that use of the tests on manured soils can result in dramatic savings on fertilizer costs and that the potential for such savings can be easily demonstrated on most Iowa farms. The results can be expressed in terms everybody understands: dollars per acre saved when unnecessary fertilization is avoided.

To update FFA chapter advisors with information concerning the new tests and provide them with plans for potential projects using these tools. It seems that most advisors are not aware of the new tests but would encourage projects with the tests if they were aware of the possibilities.

A select group of FFA advisors working with university researchers and state education coordinators are the most appropriate group to develop educational programs that can be used by all FFA advisors. Such programs will strengthen the agricultural science emphasis that teachers (FFA advisors) recognize as very important.

To promote acceptance of the new soil and tissue tests on family farms having crop and livestock production units. The FFA offers a unique and efficient means of rapidly reaching the family farms that would most benefit from using the tests. Family farms should be strengthened as profitability is increased and as the next generation of farmers appearance success associated with promoting effective new management practices.

To demonstrate to rural communities the benefits of using local resources (manure and management) more efficiently to reduce the flow of dollars from their communities. A pilot project with the FFA in Greens County, Iowa is showing that projects involving local chapters of FFA deserve more attention as a means of promoting sustainable agriculture. Rural agricultural communities tend to focus on their children and local school activities more than do most communities. Effective school activities that help retain bright young people and dollars in farm communities quickly gain the recognition and support of proud parents, local businesses, community leaders, and the popular press serving rural areas.

To develop closer relationships among researchers, extension personnel, rural community.

Method

The project includes local extension personnel, leaders and students in selected high school FFA chapters, and many farm-families in rural communities that would benefit most by using the new tests. A strong basis for the proposed project was established as the FFA members in Greens County participated in an Iowa State University research project funded by the Leopold Center for Sustainable Agriculture

Effort will focus on the Greens County FFA chapter and four other chapters to be identified after funding is granted. Primary focus will be on Greens County because this chapter already has one year of experience and, therefore, has established a basis for moving forward. The advisors of the five chapters and Eldon Weber will form an Educational Material Development Communities, which will be a key component of the project and will meet often during the project. Activities of the Greens County chapter (including those done in 1994) serve as a starting point for the communities to develop preliminary educational materials that could be used by FFA chapters anywhere. The preliminary materials will be field-tested in all five chapters in 1995 and 1996 and revised to provide an effective end product. Funding is requested to provide a small honorarium and travel expenses for five FFA advisors to work together on educational material development for five days during each of the two years of this project.

Activities of students in all five participating FFA chapters will include: assisting with replicated and randomized research/demonstration trials conducted by ISU personnel on manured cornfields selected by FFA students, using the late-spring soil test and end-of-season cornstalk test to evaluate N management on manured cornfields in the neighborhoods of the FFA student, and presenting the results during summer field days, winter meetings with farmers, and presentations to other interested groups. It is expected that more than 100 farmers will be involved in this project. It also is expected that the FFA students will have many opportunities to describe their activities before local and regional groups, so funding is requested to develop and deliver excellent presentations. Local and regional extension personnel will be involved in planning and organizing all field days and farmer meetings.

Farmer-to-Farmer Cover Crop Network Complementing On-Farm and On-Station Trials

Project Number:
LNC 95-83

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Funding:
SARE: $44,954
Match: $65,378

Duration:
September 1995 - August 1997

Keywords:
Cover Crops
Education/Extension/Networking

Abstract
A network of farmers will share ideas, practical experiences and research information on cover crop rotations. Priority management questions in legume-based crop rotations in South Central Kansas have been identified. The Heartland Network is a farmer-to-farmer network based on the knowledge that farmers learn from each other's practical experiences and through a cooperative shared interest invite land grant researchers to conduct complementary research.

A collaborative process will build partnerships between farmers and Kansas State University (KSU) researchers on the assessment of crop productivity, soil quality, nitrogen sorghum rotation. Fifteen farmers across two farmer clusters will conduct cover crop trials on their farms with narrow, farm-scale plots. Two KSU Experiment Stations will conduct complementary research. Joint visits on farms and stations and farmer-scientist focus sessions will develop the research partnership.

Outreach will include field days, written articles, educational workshops, an evaluative case study on the research process, and a bulletin on continuing development of the partnership between farmers and researchers.

Objectives
A network of farmers will share ideas, practical experiences and research information on cover crop rotations. Priority management questions in legume-based crop rotations in South Central Kansas have been identified. Cover crop management guidelines will be developed to assist farmer decisions in the region. Farm trials will test priority management questions. The farmers will work with soil quality test kits to begin to evaluate the soil quality benefits of their cropping practices. Knowledge learned will be transferred to neighboring farmers and researchers.

A collaborative process will build research partnerships between farmers and Kansas State University researchers on the assessment of soil quality, crop productivity, soil water use, and economic profit with cover crops in a wheat-grain sorghum rotation.

Farmers and researchers bring different capacities toward the development of cropping systems. Research partnerships are needed between both parties to identify which questions can be tested most effectively at which site, how knowledge collected from both farms and stations can be integrated together toward a better understanding of a new cropping system, and how this information can best be transferred to other farmers to achieve broader sustainability.

Method

Through a series of 10 meetings over the past 10 months, farmers with KSU station researchers have prioritized a list of cover crop research questions and identified trial designs that incorporate on-farm and on-station research. A participatory rural assessment technique was used to have farmers discuss and rank priority management considerations. Priority management questions presently focus on profitability, soil fertility and quality, soil water conservation, cover crop establishment and winter hardiness. This technique will be used periodically throughout the project to clarify research needs and assist in the development of cover crop management guidelines. A joint planning meeting among all major research participants created an interdisciplinary team to develop the project proposal.

This discussion between farmers and researchers has stimulated current cover crop trials on both stations and among a half dozen farmers. Due to interest in this project, the stations are conducting preliminary trials on tillage, fall planting dates and rates. Farmers are conducting legume and check strips to compare cover crop growth and sorghum yields. This field learning will build into this expanded project.

Domestic Birds as Weed and Insect Pest Biocontrol Agents: Field Experimentation and On-Farm Evaluation

Project Number:
LNC 95-82

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Funding:
SARE: $25,200
Match: $21,136

Duration:
September 1995 - August 1997

Keywords:
Biological Controls
Pests Management

Abstract

The re-integration of domestic birds into agroecosystems may provide a variety of benefits to the operators of small farms. Benefits can include improved nutrient cycling and utilization, sanitation, and the addition of marketable products including meat, eggs, and down. With appropriate management domestic birds might also be used as weed and insect biological control agents. Chickens are omnivorous and when free-ranged will consume weed seeds, seedlings, and insects (Clark et al. in press). In contrast, geese are herbivores and feed upon a variety of grasses and broadleaf plants. Both of these birds have the potential to be biological control agents. The overall objective of this research is to increase our understanding of the ecological, economic, and social factors which allow or promote the integration of domestic birds as biological control agents on farms.

There is currently very little experimental documentation on use of domestic birds for the natural regulation of pests and weeds. Nevertheless, there is anecdotal information which warrants experimental testing. Chickens have been used and are currently being used to control two insect pests: plum curculio *(Conotrachelus nenuphar)* on apple and Colorado potato beetle (*Leptinotarsa decemlineata*) on potato. The first objective of this research project is to evaluate the effectiveness of chickens at reducing numbers of these pests as well as several other insect pests of these two crops.

Experimental, historical, and anecdotal information exists on the use of domestic birds, especially geese, as weed biocontrol agents. Geese have been used in a variety of agroecosystems for weed management including fruit orchards, potatoes, cotton, and strawberries. Goose production operations might be integrated with vegetable and/or fruit production operations to yield benefits to both operations -- food resources for the geese and weed control in the crops. Information is needed, however, on the compatibility of crops with geese.

The use of geese to control weeds in certain crops may be an economically viable alterative to herbicides and mechanical cultivation for small farms. Several crops, including cotton, strawberries, and potatoes, are known to be compatible with weeder geese. In contrast, other crops, such as corn and small grains, known to be preferred foods of geese and therefore incompatible. However, much more documentation concerning which crops are compatible and which are not is needed.

Such information would be valuable in aiding those small farmers and market gardeners interested in using geese for weed management. The second objective of this project is to evaluate the compatibility of common vegetable crops with weeder geese. Both the first and second objectives of this research will be conducted in a 2 ha experimental apple orchard at the Kellogg Biological Station of Michigan State University.

Field trials, however rigorous, can not replicate the conditions on-farm, nor can they, of themselves, address the factors that lead to the adoption of more low-input agricultural practices. The utilization of domestic birds as biological control agents will depend on a farmer's philosophy toward sustainable agriculture and animal agriculture and on the actual ecological conditions and management arrangements that exist on farm -- in short, on a farmers's knowledge of, and assessment of, his/her physical and social environment.

Utilization will also depend on how agricultural policy and the larger food system impact the farming enterprise. Therefore, the third objective will explore, using six case studies, how domestic birds are being used on-farm and why each case represents a small-scale, chemical-free, direct marketing enterprise. Qualitative and quantitative methods of data collection will be used to more fully describe the diversity of farming contexts and to identify those factors that enable and/or constrain the integration of domestic birds into local agroecosystems.

Objectives
To evaluate common vegetable crops for their compatibility with weeder geese.

To evaluate the compatibility of common vegetable crops with weeder geese.

To explore, using six case studies, how domestic birds are being used on-farm and why each case represents a small-scale, chemical-free, direct marketing enterprise.

Method
The compatibility of weeder geese with 12 vegetable crops (tomato, eggplant, bell pepper, jalapeno pepper, broccoli, cauliflower, cucumber, carrot, snap bean, garlic, onion, and sweet corn) will be evaluated in a replicated experiment at the Kellogg Biological Station, Michigan State University. The experiment will be conducted from April to September, 1995. Six test gardens (each measuring 4m X 50m) will be established within an experimental, non-chemical apple orchard with 7.2m tree spacings.

The orchard will provide a shaded habitat which allows the geese to actively forage even during hotter parts of the day (Clark et al. in press). Four of these gardens will be randomly selected for weed management using a flock of four African geese. Two gardens will be early planted (early May) and two will be late planted (mid-May) to evaluate the possible interactions between plant size and goose compatibility. These four gardens will be surrounded using plastic fencing (1.5 m high, 5 cm mesh) and include an adjacent tree row for shade. The remaining two gardens will be hand weeded throughout the season and serve as a control. Four African geese, 5-6 weeks old, will be introduced in early to mid-June. They will be allowed to forage until most of their preferred forage is eliminated (Gage et al. 1994) and reintroduced when new weed seedlings become available. This periodic grazing will be conducted until mid- to late August.

The compatibility of the weeder geese will be assessed with visual observations, crop and weed growth assessments, and crop yield measurements. Observations will be conducted to determine if particular crops are fed upon or trampled by the geese. Crop growth and weed growth will be monitored throughout the growing season with percent-ground cover estimates made weekly with a 1 meter-squared sampling quadrant. Yields will be determined for each crop by weighing all fresh vegetable harvests.

Nebraska Agricultural IMPACT Project

Project Number:
LNC 95-81

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Funding:
SARE: $106,254
Match: $279,598

Duration:
September 1995 - August 1997

Keywords:
Quality of Life
Education/Networking/Extension

Abstract
The Nebraska Agricultural IMPACT Project will support local groups of beginning and established farmers in researching, demonstrating and learning about sustainable farming systems. Three key agriculture organizations will collaborate to provide group organization support, design of on-farm projects, and networking linkages to other farmer groups and organizations.

The Project will recruit farmers and ranchers to form local sustainable farming IMPACT groups, which will include non-farm community members and local Extension Educators. IMPACT groups will be encouraged to include technical assistance providers such as NRCS specialists, research station scientists, and Natural Resource District staff. At least 10 groups will be supported around the state. Local groups will foster community support for and increased adoption of sustainable farming systems.

Specific emphasis will be placed on recruiting and including beginning farmers and ranchers in IMPACT group activities. We will make a special effort to engage beginning farmers by including them in existing groups or by forming groups primarily of beginning farmers. Exposure to sustainable practices at this early career stage will improve these farmers acceptance of such practices and will improve their ability to successfully enter into farming.

The IMPACT Project will evaluate farmer/rancher participating groups and activities, beginning farmer participation, changes in institutional relationships with each other and with farmers, and achievement of outreach activities.

Objectives
Establish 10 or more IMPACT groups across Nebraska and provide staff and financial support to the on-farm research/demonstration and education efforts of those groups.

Increase the ability of beginning farmers and ranchers to implement sustainable agriculture practices and to become established farm operators.

Strengthen the University of Nebraska institutions to provide community-level support for adoption of sustainable agriculture across the state through a collaborative effort between the Center for Rural Affairs (CRA), the Nebraska Sustainable Agriculture Society (NSAS), the University of Nebraska-Lincoln (UNL), and Nebraska farmers and ranchers.

Share the lessons learned in this project with farmers, organizations and institutions elsewhere.

Methods

At least 10 IMPACT groups will be established in year one, with at least one group in each of the five Extension regions in Nebraska. Additional groups may be established in year two. The IMPACT Project is operating on a limited basis at the time of this proposal. No groups have yet been established, but at least five groups will be have been funded by the time this proposal would take effect. These groups will meet regularly and provide a process controlled by farmers through which they can learn, share information, evaluate, and experiment with new ideas and approaches, and gain greater control over their farming operations.

A full range of interested farmers will be recruited for IMPACT groups, including beginning farmers, established sustainable farmers and conventional farmers interested in converting to sustainable farming systems. Groups will be encouraged to include interested non-farm community members in their activities, especially those with possible links to farm businesses or farm credit suppliers. Their inclusion will help build broad community support and understanding of sustainable farming systems.

Each IMPACT group will choose and design its own activities, which may include farm tours, on-farm research, mentoring activities, etc. Groups will be encouraged to apply whole-farm strategies rather than single practices. Group members may choose to do an on-farm project or may choose to observe, discuss, and learn from other group members. Project staff will provide support with these activities as well as provide training in on-farm research techniques, holding effective meetings and programs, communication skills, and goal setting.

We will provide each IMPACT group with funds for organizing expenses, as well as access to additional funds for carrying out locally initiated programs, contingent upon development and approval of a research or educational plan for use of those funds. (The IMPACT steering committee, composed primarily of group representatives, will evaluate group proposals and award funding.) Project staff will assist with these initial planning activities and will eventually train groups to prepare proposals to other sources.

Importing a Sustainable Model of Feeder Pig Production from Sweden: a Cooperative Project

Project Number:
LNC 95-80

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Funding:
SARE: $81,513
Match: $65,878

Duration:
September 1995 - August 1997

Keywords:
Livestock Production
Networking
Markets

Abstract
Public concerns are increasing over the environmental, animal welfare, and public health impacts of intensive confinement hog production and liquid manure. *Vastgotmodellen* meets or exceeds Sweden's strict standards for animal welfare, environmental quality, drug use and worker and food safety.

It is desirable to show that systems whose primary goals are to protect the natural environment and improve quality of life for humans and animals achieve similar productivity and profitability to systems of production which tend to put those qualitative objectives in second place.

Independent hog producers may face reduced market access in the future. As well, prices smaller producers receive from packers may be lower than those received by high-volume operators, putting smaller producers at a competitive disadvantage with those operators. It makes economic sense to start now to identify demands that may exist for special characteristics possessed by project hogs or by the production process itself.

There is a need for models of pig production compatible with the scale, resources, values and management objectives of small to mid-sized, diversified farmers. Based on the natural behaviors and biology of pigs, the Vastgotamodel uses modern, all in-all out methods and integrates on-farm produced inputs to improve animal health and performance and farmers' efficiency. This project is anticipated to demonstrate what it takes to adopt such a sustainable model in the U.S. agricultural economy .

Objectives
To help selected American farmers adopt the Swedish Vastgotamodel of feeder pig production and serve as mentors and models for others.

To study and document the model's contribution to farmer and animal health and welfare and ecology of the farming operation.

To collect and analyze data on inputs and outputs, costs and returns, management requirements, and individual pig health and productivity on participating farms and compare them to intensive confinement herds in PigCHAMP and/or other appropriate databases.

To publicize the results and assist farmer-participants to mentor other adopting farmers.

To explore and identify alternative markets for project pigs and help project farmers gain access to them.

Results

With matching funds from the Leopold Center for Sustainable Agriculture at Iowa State University, we have nearly completed construction of a biotech building at the Iowa State University research farm at Lewis, Iowa. This building will house boars, gestating sows and the mating area for the Swedish model. We are remodeling an existing building at the same farm for the group farrowing and lactation/growing stage of the model. Once they are operating these will be used for research and demonstration and will be open to the public. Swine facilities at a second Iowa State University research farm at Newell, Iowa are also being considered for conversion to the Swedish model.

The Effect of Spring-Seeded Annual Medic on Weed Management and Soil Quality in Corn Production

Project Number:
LNC 95-79

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Funding:
SARE: $73,000
Match: $69,600

Duration:
September 1995 - August 1997

Keywords:
Cover Crop
Legumes
Rotation

Abstract

The use of annual medic as a smother crop promotes good stewardship of the nation's soil and water resources and benefits worker health and safety. Annual medic will reduce weed pressure, thereby reducing the amount of cultivation and herbicide needed in corn production. The reduction in cultivation will lead to reduced soil erosion and related sedimentation in streams and lakes. Reduced herbicide inputs will result in increased environmental quality due to less offsite herbicide movement through volatility and drift, and reduce contamination of surface and groundwater from herbicide residues. Herbicide reduction also will reduce worker exposure to these chemicals and aid in protecting the health and safety of persons involved in the food and farm system. Medic will also enhance soil quality and productivity by increasing water infiltration, reducing compaction, fixing N to be used by subsequent crops, and increasing organic matter content by producing biomass. The economics of a medic-based system for weed management also may be extremely favorable. Costs that will be reduced due to lower input levels include cultivation, herbicide, nitrogen, and labor. These reductions should increase profitability of the farm as a whole.

Management systems that incorporate rotations or smother crops to control weeds and/or supply plant nutrients may reduce agrichemical applications. However, these systems must: maintain acceptable levels of productivity for the grower, be effective, fit into management and be economically feasible. Preliminary component research has shown that spring-seeded annual medic suppresses weeds and supplies N and organic matter to soil. Additional research is needed to optimize annual medic use to improve soil quality and reduce weed pressure within crop rotations that include corn. The research outlined in this proposal will lead to the integration of medic into reliable, sustainable systems of management. The research hypothesis is that annual medic suppresses weeds. Weed suppression will reduce herbicide and cultivation inputs, and improve soil quality, N supplying power of the soil, profitability, and productivity.

This research will: 1) quantify weed suppression by annual medic in corn production systems; 2) determine medic's impact on soil quality; 3) determine corn productivity in the proposed medic systems; and 4) evaluate economics of annual medic in corn production. In a two-year study, upright and prostrate species of annual medic will be planted at several seeding rates and planting dates in combination with corn in Eastern South Dakota and Western Iowa. Weed suppression, soil quality (soil organic matter content, N, bulk density, and water infiltration), corn productivity, and costs of annual medic systems will be quantified.

The proposed research is a collaborative effort between weed, soil, and agricultural production scientists. Medic use must be fine-tuned in the production environment including defining optimum species or combination of species to grow, seeding density, and planting time relative to corn.

The systems developed will maintain corn productivity, reduce agrichemical inputs, and be readily adoptable by growers because the systems use current technology.

Annual medic used in corn production will enhance sustainability and environmental quality by using renewable resource inputs and biological cycles to augment and reduce agrichemical inputs and cultivation requirements simultaneously. The chemical reductions will improve environmental quality by reducing offsite chemical movement to water and nontarget areas. Cultivation reductions will reduce soil erosion, fuel costs, and labor. The cover provided by medic will improve soil quality. Both farmers and society will benefit from the outcome of this research.

Objectives
Quantify weed suppression by two species of annual medic in corn rotations.

Determine medic=s impact on soil quality including organic matter content, water infiltration, N contribution to soil, and bulk density.

Determine corn productivity in the proposed medic systems.

Evaluate economics of annual medic in corn production.

Outreach
Experimental areas for this two-year study will be on South Dakota State University and Dordt College field stations. The plots will be included on tours for grower field days (one to two times each year). As system(s) are developed that give favorable results, large scale plots will be placed in growers fields for demonstration (with field days to be held in July or August) and further evaluation and validation of the system(s). Technical research reports will be written for inclusion in journals such as *Weed Science* and *Journal of Production Agriculture*. Nontechnical reports will be included in yearly experiment station bulletins, *Farm and Home Journal*, agricultural extension bulletins, and popular press reports. Results will also be presented at extension meetings (held January - March), annual seed trade meetings, and at other appropriate venues. A segment will be prepared for the TV program, *Today's Agricultural*, a 30.minute show airing on Sunday nights in South Dakota, to highlight the research and results of this study.

Development of a Rancher Cooperative to Market Grass-Fed Meat

Project Number:
LNC 95-78

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Funding:
SARE: $33, 000, Total
Match: $20,400, Total

Duration:
September 1995 - August 1997

Keywords:
Marketing
Business Development

Abstract
A core group of Flint Hills ranchers has met monthly for a year to discuss their mutual interest in jointly marketing grass-fed meat. They are interested in developing a business structure for processing and marketing their meat which would allow them to retain control, possibly some form of cooperative. They feel the need to research grazing practices and develop production standards and carcass grading standards in order to improve their product. They need information on market demand and marketing practices for their meat. They wish to have their meat processed in a way that would aid the local economy. They would like to reach out to consumers to help them understand the environmental benefits of meat raised primarily on grass instead of in the feedlot. The project is designed to help them with all of these issues.

The potential for a grass-fed livestock industry will be researched in the first year, including a search of materials on the Kansas livestock industry, and other information on grass-fed beef and lamb. Also during the first year, business structures will be investigated, including cooperatives and closed cooperatives. After deciding on a structure, suitable bylaws will be developed to allow the organization to proceed, with an emphasis on remaining accountable to rancher members. Officers and directors will attend training workshops. Production standards and carcass grading standards will be researched, including literature reviews and visits to university and commercial grazing and processing facilities. Market research will begin with interviews of successful marketers, but will also include literature reviews and actual test marketing using restaurateurs, focus groups and individual sales. Processing options will be explored, first with small-scale local locker plants.

Objectives
To found a marketing cooperative, or other legal rancher-controlled business structure, with a defined group process for decision-making and project implementation. Rationales include: retaining farmer/rancher control so that the business entity must make decisions in their best interests rather than favoring the cheapest supply; a defined group decision-making process will bring clarity to all members and allow people who have not worked together before to become partners.

To develop production standards and carcass grading standards for high quality meat products identified as "grass-fed." Rationales include: protection of native grass from the plow; increase in wildlife and bio-diversity; decrease in rowcropping to supply feedlot grains and consequent decrease in the use of agricultural chemicals; animal well-being; manure dispersal; lowered use of fossil fuels; and increased profits to ranchers, not feedlots. Rationales also include: a desire by the ranchers to sell only a high quality product; a need to have a high quality product in order to find a place in the market; a need to fill a vacuum of knowledge about how grass-fed meat can be finished; and finally, to bring clarity to carcass grading in order to avoid misunderstanding between producers.

To conduct market research with consumers to determine consumer desires in a grass-fed product. Rationales include: developing a product which can find a market; educating consumers to the availability of meat raised in a sustainable manner; the amassing of information on market size and desires so that production can be planned; and higher profits to ranchers for producing meat this way. Target audiences include health conscious consumers, environmentally motivated consumers, those seeking meat produced with the animal's well-being in mind, and those interested in purchasing products by identifiable producers.

To explore processing options with small-scale meat processors. Rationales include: the fact that core members are ranchers and at this time they do not wish to become meat processors; members are interested in enhancing their local economies; and members are interested in a "regional" product which is grown, processed and consumed in their home area as much as possible.

To develop a business plan that would combine the results of the production, processing and marketing studies. Rationales include: having the best information available in order to proceed; helping to build group cohesion by clarifying the projects activities; and having a sound basis for the business should additional funding be needed. Target audience includes other groups interested in this type of grass-fed meat operation, university and business management personnel who may be interested in alternative business structures, and banks or other funding sources who may be called upon to finance similar operations.

Hedgerow Habitat for Enhancing the Impact of Beneficial Insects

Project Numbers:
LNC 94-77
ANC 94-22

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Funding:
SARE: $27,894
ACE: $32,683
Match: $34,800

Duration:
October 1994 - September 1996

Keywords:
Biological Controls
Crop Production

Abstract:
Hedgerows of flowering plants can greatly increase the activity and effectiveness of natural enemies of pest insects. However, the relative attractiveness of cold-hardy perennials and shrubs to natural enemies is undocumented. Based on the existing literature, plant architecture, and pollination ecology, we will select hardy perennial shrubs and flowering plants which are likely to provide natural enemies with habitat and resources that may be lacking in vegetable cropping systems. Hedgerows containing the most promising of these plants will be established in one field on each of three Wisconsin fresh market vegetable farms.

The impact of natural enemies will be examined on cole crops both adjacent to and isolated from hedgerows. Water pan and pitfall traps will be used to assess the diversity of insects at various distances from the hedgerow plantings into the crop. Hedgerow attractiveness and impact on beneficials will be rated using data collected in cabbage plots with and without hedgerows through field scouting, collection of pests for rearing of parasitoids, and exclusion methods to evaluate the impact of predators and parasitoids on pest populations. Finally, the role of these hedgerows in the overwintering of pest and natural enemy species will be studied by trapping all insects that emerge in the spring inside field cages erected over hedgerows during winter.

Hedgerows and cabbage plots will be established on three fresh market vegetable farms in Wisconsin as a collaborative effort between the farmers and University of Wisconsin entomologists and a graduate student. Insect sampling will primarily be the responsibility of the student, but farmers will assist in operating insect traps. All project participants will contribute their expertise in outreach of project results.

This work will increase our understanding of both the ecology and the potential of natural enemies on Wisconsin's many fresh market vegetable farms. Providing enemies with essential resources and quality habitat should increase the local carrying capacity for beneficial species, and permanently suppress the populations of pests.

Cabbage was chosen as a model crop to study because of its broad complexes of pest and beneficial insects, so the results of this study should apply to other vegetable cropping systems as well.

Objectives
Establish hedgerows of flowering shrubs and perennial flowers in one field on each of three Wisconsin fresh market vegetable farms.

Monitor the relative attractiveness of the various hedgerow plants to beneficial insects throughout the growing season.

Determine the impact of the hedgerows and associated beneficial insects on the pest complex of cole crops.

Examine the role of the hedgerow plantings as overwintering sites for both beneficial insects and pests.

Share the results of this work with the interested public.

Method
Extensive hedgerows have already been established at Harmony Valley Farms, with partial support by a demonstration grant received by the farmer from the Sustainable Agriculture Program of Wisconsin's Department of Agriculture, Trade and Consumer Protection. Harmony Valley is a diverse 40-acre fresh market vegetable farm located near LaCrosse in Vernon County, Wisconsin. These hedgerows contain a diversity of shrubs and perennial flowers. On 4 dates during summer 1993, preliminary studies were done by setting out yellow water pan traps at flower height alongside 10 different types of hedgerow plantings. Traps consisted of yellow plastic bowls filled with water and detergent and fastened atop wooden stakes. Traps were run for two to three mid-afternoon hours on three dates and 10 hours on one date. The goal of the trapping was a relative measure of insect activity associated with each hedgerow type. Trap contents included Hemiptera, Homoptera, Hymenoptera (Parasitica and Apocrita), Coleoptera, and Diptera.

Outreach and Evaluation
The most effective way to demonstrate this type of project is through field days, which will be held at each location during the second summer of the project. These will be publicized through press releases to the regions agricultural newspapers, to several area farmer networks, to the vegetable growers association, to coordinators of area farmers markets, and to the Wisconsin Kraut Growers Association. Presentations will include a synopsis of the biology of some common beneficials, a discussion of hedgerow culture and management, a summary of results at that particular farm and the other two, and a tour of the field.

The second approach in publicizing the results of this study will be presentations at winter meetings of grower groups. These include the Fresh Market Vegetable Growers Association, the Wisconsin Kraut Growers Association, the Upper Midwest Organic Farming Conference. Presentations to each of these groups will be oral presentations in a style typical of other presentations at each meeting; visual aids such as slides and handouts will be used as appropriate. Evaluation of these presentations will be based on the attendance and amount of discussion generated at each meeting.

Overall evaluation of the project will proceed along two lines: hedgerow impact on insect activity, and economic aspects of hedgerows. First, the impact of the hedgerow plantings on the beneficial and pest complexes on the adjacent cabbage field will be determined and compared to the insect activity on the cabbage plot isolated from hedgerows. With the snow fence segment of hedge, we will be able to compare the shelter effect to the biological effects of hedge segments. Although this study will be replicated only three times, and will not be subject to rigorous statistical analysis, the many types and large amount of data to be collected should clearly indicate any useful trends. Overall pest abundance, incidence of parasitism, and the need for application of botanical, microbial, or chemical insecticides will form the bases for evaluating these comparisons.

Pasture-Based Beef Finishing Systems

Project Numbers:
LNC 94-76
ANC 94-21

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Funding:
SARE: $60,000
ACE: $51,817
Match: $34,074

Duration:
October 1994 - September 1996

Keywords:
Livestock Production
Waste Management

Abstract
The first year of a two-year study has been completed. The study was designed to research the finishing of beef cattle on pasture without the use of a confinement feedlot. Such a finishing system has the potential of economizing the cost of gains and disperses the animal waste over a broad pasture area where it can be utilized as soil nutrients to grow more pasture. Varying numbers of 700 to 800 lb crossbred steers were randomly allocated according to appropriate stocking rates to five experimental treatments. Treatments were as follows: 0 percent) pasture + no grain supplement; 25 percent) pasture + grain supplement to supply 25 percent of animal nutrient requirements; 50 percent) pasture + grain to supply 50 percent of requirements; 75 percent) pasture + grain to supply 75 percent of requirements; and FL) feedlot ration containing 10 percent ground hay with no pasture. Each intensively managed pasture was eight acres grazed from April 21 to November 2, 1995.

Steers gained more rapidly with each increment of grain supplement fed which resulted in the 0 grain group having the least finish and the feedlot group having the most finish. Over half the feedlot steers graded choice whereas all but 4 of the 0 grain supplemented group graded standard. The low grades for the 0 and 25 percent groups of steers were because they were about 100 lbs lighter in weight at slaughter than the FL and the 75 percent steers. Had these steers been fed an additional 30 to 45 days, they would have been of equal finish. The steers were removed because the pastures were exhausted and because a major focus of this study is meat flavor analysis. Therefore, we wanted to slaughter directly off pasture so as not to affect flavor by some other type of ration. Fat color did not appear to be a problem since all carcasses were relatively light in color. Cost of gain was near or less than $40 /cwt for the 0, 25, and 50 percent treatments.

Objectives
To develop profitable systems for pasture-finishing beef cattle of consistent and acceptable carcass quality.

To evaluate an intensive pasture-based beef finishing system in terms of animal waste dispersion.

To demonstrate in a pilot commercial-sized trial, the feasibility of marketing pasture-finished beef using an integrated alliance model.

Results

The grazing trial scheduled for the season of 1995 has been completed. Treatments ranged from zero supplemental grain to a conventional feedlot treatment and grain was fed as a percent of the total nutrient intake which would come from the grain supplement, for example for the 25 percent grain level about 25 percent of the total nutrient requirements of the steers was from grain. The feedlot treatment was replicated at the feedlot located at the FSRC a separate site from the pastures. The number of steers used per treatment was varied because as grain supplement increased, pasture consumed would decrease hence a higher stocking rate was required on higher grain feeding treatments. The number of steers per treatment in the zero grain system was based on previous experience with stocking rate on similar pastures here at the Forage Systems Research Center. The pastured steers used 6 paddocks which were subdivided by using electrified polytape to allocate a new pasture each time the steers were moved. Steers were moved every two or three days during phase I and each day during phase II.

Steers from the feedlot treatment were harvested September 29, 1995 and cattle from the pasture treatments were harvested November 4, 1995. The goal was to slaughter cattle when backfat was .3 to .4 inches, but the pasture-based cattle were out of pasture so they were killed before they reached target finish. The major reason for this approach was to be able to clearly evaluate the flavor of the resulting meat. Meat flavor and fat color are the most frequent criticisms of pasture-finished beef. The hypothesis for this study is that feeding grain supplement on pasture will dilute out any off flavor due to the pasture and the resulting meat will be comparable to grain finished beef. Since we were awarded this grant, we have been given additional funds from the Missouri Agricultural Experiment Station to perform taste tests on meat samples from the cattle carcasses produced from this trial. Therefore, we wanted to slaughter directly off pasture and chose not to use a short feedlot finishing period to reach our target finish.

The summer pasture season was divided into two phases because the gains were not as good as expected early in the grazing period. During this period there was only .25 lb ADG difference between treatment 0 and 75 percent grain supplementation. We would expect a difference of about 1 lb ADG or more. The hot weather combined with extremely high humidity during that period probably depressed gains in all treatments but since grain has less heat increment than forage the heat load on the grain supplemented cattle should not have been as severe as was observed. Also the feedlot cattle gained well during phase I. Therefore, we changed some management practices being used: 1) The grain supplement was reformulated from all cracked corn to a mixture of 70 percent cracked corn and 30 percent corn gluten feed which added fiber to the ration to prevent acidosis and promote appetite; and 2) The steers were given a fresh paddock of pasture daily during phase I to promote pasture intake. These changes seemed to be successful because the steers seemed to have improved appetites in phase II and the ADG's were improved. Phase I was 100 days in length and phase II was 75 days.

In general, all quality measures increased as grain level increased. Slightly over 50% of the carcasses in the feedlot group graded choice, whereas all but 2 carcasses in each replication in the 0 grain group graded standard. In the market these carcasses were docked severely so that their value was $220 less than the feedlot steers. With as little as 45 days in the feedlot these cattle would have probably graded similar to the feedlot group and the carcass value would have also been similar.

Biological, Financial and Social Monitoring to Develop Highly Sustainable Farming Systems

Project Numbers:
LNC 94-75
ANC 94-20

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Minnesota Pollution Control Agency

U.S. Fish and Wildlife Service

Funding:
SARE: $50,000
ACE: $50,000
Match: $266,265

Duration:
October 1994 - September 1996

Keywords:
Livestock Production
Quality of Life

Abstract
Sustainable farming practices are being developed by farmers and researchers in response to a number of environmental and economic problems associated with conventional agriculture in the U.S. Currently neither farmers or researchers have sufficient knowledge about what or how to monitor on their farms to determine the effects of sustainable practices.

An example of a sustainable farming system that is an alternative to conventional animal agricultural production systems is Management Intensive Grazing (MIG). MIG appears to be an example of a farming practice that uses minimal off-farm inputs, increases profitability, improves farm family quality of life, and reduces soil erosion (Parker et al, 1992; Zartman, in press). As farmers in southeastern Minnesota turn to MIG, representatives of conservation groups and natural resource agencies also are being attracted by the potential for greatly reduced soil erosion and water quality impacts, as well as by improved habitat for both terrestrial and aquatic species (Hawkins, 1993 personal communication; Robinson, 1990). In this project, monitoring methods will be applied to farms in various stages of transition to MIG.

Many farmers are looking for highly sustainable farming systems, such as MIG, that reduce the cost of inputs, maintain or improve the resource base, and protect human health (NRC, 1989). They also are looking for approaches to research that include farmers as members of research teams working on problems relevant to their farming systems (Ikerd, 1993; Mulins, 1991).

What farmers are missing are the tools to assess concretely whether new management systems are actually moving their farm and families health in the desired direction. Monitoring for ecological, financial and quality of life changes is needed.

This project will develop and test indicators that will help farmers to monitor the ecological health, financial and family quality-of-life changes resulting from adoption of sustainable management systems.

During the summer of 1993, our team of 19 farmers, university researchers, natural resource and agricultural agency staff, nonprofit staff and consultants worked as partners to identify monitoring approaches and develop this proposal. All team members will be involved in data collection and interpretation, and the evaluation of the project.

Monitoring methods will focus on farms in various stages of transition to Management Intensive Grazing (MIG), because this appears to be an example of a sustainable farming practice. We will monitor biological, economic and family quality-of-life parameters over time on five to eight farms that are undergoing a transition from conventional farming to MIG.

This project will produce a kit of indicators that farmers can use themselves to monitor changes on their farms. The data collected by this project will help farmers and agency officials evaluate the impacts of adopting MIG. The project will develop and model a participatory whole-systems research process. To involve additional farmers and to promote the results, we will organize education and feedback sessions on an on-going basis and widely disseminate the results of this study through field days, papers and brochures.

Objectives
Develop indicators of ecosystem health that can be easily used by farmers.

Assess social and economic well-being of farms implementing MIG.

Implement and evaluate a new model for designing agricultural research. This model is farmer-driven, uses a whole-systems approach, and depends upon multi-directional communication and cooperation among a variety of disciplines and professionals concerned with land stewardship. Whole systems research emphasizes interpreting facts in a way that relates them to the real world, including qualitative as well as quantitative analysis. Through a participatory process, the farmers, who are the intended beneficiaries, are given a direct role in the design of research, documentation of findings, and demonstration of new management approaches resulting from their research. Moreover, academic researchers, agency, non-profit and for-profit personnel also participate in a process that can change their perceptions about how research and policy should be developed and conducted.

Promote the use of participatory, inclusive, whole-systems approaches in other research.

Engage the alumni of LSP's "Introduction to Holistic Resource Management" (HRM) seminars in an on-going discussion. These alumni will act as "focus groups" to provide the feedback necessary to be sure the research is truly "farmer friendly," useful, and relevant to the realities of farming.

Disseminate information to farmers and policy makers about the use of biological monitoring and MIG.

Dissemination of research results through a variety of means will help create an improved climate for cross-fertilization of ideas and creative problem-solving among farmers, researchers and regulators.

Improving Sustainability of Cow-Calf Operations with Natural Forage Systems

Project Number:
LNC 94-74

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Funding:
SARE: $82,000
Match: $258,400

Duration:
August 1994 - September 1996

Keywords:
Livestock Production
Quality of Life

Abstract

Nearly 44 percent (73.7 million acres) of the area in the North Central states of Kansas, Nebraska, North Dakota, and South Dakota is range or pasture land. Over 5.5 million beef cattle graze these lands (U.S. Dept of Commerce 1989). Because of precipitation, soil, topography, etc., a large proportion of the range and pasture land is suited only for grazing, and cropping enterprises do not exist.

While grazing land is an important input, harvested forages, grain and feed supplements made up over 40 percent of total cash costs in North Central cow-calf operations in 1990 and 1991. A five-year Integrated Resource Management (IRM) project also found feed to be the greatest and most variable cost to Nebraska beef cattle operations (Rasby et al. 1989).

The quantity and quality of forage produced on pasture and rangelands are highly cyclical, both within and between years. Plants contain their greatest nutrient value for cattle before maturity. In late maturity and after plants quit growing, forages may not provide adequate nutrients for production or maintenance of the cow herd, depending on the cows' physiological state. Pregnancy and lactation significantly increase nutrient requirements of the cow.

Low quality, dormant grasses generally will not provide sufficient nutrients for lactation or advanced pregnancy. When standing range or pasture forages will not meet the requirements of the cow, purchased and/or harvested forages, grains and protein concentrates are generally fed. The amount of harvested and purchased feeds required to sustain a cow herd is highly correlated with date of calving. Researchers and others have long been aware of these facts; however, the majority of research has been directed towards adjusting the forage system to meet animal requirements and maximizing output. Forage adjustments often considered have been planting of cool season grasses, chemical control of woody species, irrigated pastures, and production of different forages such as alfalfa. While many of these adjustments have been found to be helpful, they require changing the natural forage system and the use of purchased inputs, including energy and chemicals for tilling, planting, harvesting, and feeding.

Adjustment of calving date is another way to better match nutrient requirements of cattle with nutrient content of natural forages. Such an adjustment can be made by most producers who utilize range or pasture and does not require altering the natural environment.

In Nebraska's Sandhills and many other Great Plains and North Central states, calving in late spring or early summer would match the highest nutrient requirements of the cow with the highest nutrient density of range and pasture forage. We estimate that 2,000 pounds of harvested forage can be saved per cow each year with summer (June) versus early spring (February-March) calving. Changing the calving date may also offer more opportunities to grow calves primarily on a forage diet.

The hypothesis to be tested is that labor and purchased inputs can be reduced and sustainability improved by making adjustments in season of calving and/or extending the grazing season in cow calf systems. Total resource use (i.e., labor, equipment, feed, etc.), production output, and profitability of traditional March calving will be compared to a June calving system for grazing systems with and without extended grazing seasons. Grazing season will be extended by grazing subirrigated meadows during spring, summer, and fall, and upland range during winter. This project will result in new and refined management practices of both cattle and forage, which will increase profitability and sustainability of beef cattle operations dependant on range and pasture forages.

This project will also bring greater cooperation and improve communication between producers, state and federal agencies, and producer groups such as the Nebraska Cattlemen and the Nebraska Chapter of Holistic Resource Management (HRM). Impacts of calving date and extending the grazing season will be measurable by determining inputs and profitability in a controlled experiment and with producer records.

Objectives
Compare total resource use (especially labor, equipment, and feed), production output, and profitability of traditional March calving to a June calving system.

Compare total resource use, production output, impacts on the native subirrigated meadows, and profitability of extending the grazing season by grazing of subirrigated meadows during spring, summer, and fall and by grazing Sandhills winter range.

Educate 250 producers per year about the concept of matching nutritional requirements of cattle to the nutritional output of natural forages.

Evaluation
Project outcomes will be evaluated by inputs and profitability in the controlled experiment and by producer records. Effectiveness of technology transfer will be evaluated by the number of producer and technical people (i.e., NRCS) involved in workshops, field days, and media production and by surveys of producers involved. All cooperating participants of the project will help evaluate the success of each objective.

Comparing Farming Systems with Different Strategies and Input Levels: A Research/Education Program with Replicated Micro-farms

Project Number:
LNC 94-73

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Funding:
SARE: $119,054
Match: $136,197

Duration:
October 1994 - September 1996

Keywords:
Agroforestry
Organic Systems

Abstract
Extrapolation of research results on cropping or livestock systems to farm level is complicated by the small scale of plot or pen techniques and use of non-commercial experimental equipment. Most results from small research or demonstration plots are further limited by lack of relevant measurements of system performance; data frequently reflect narrow evaluation of single components, crop yields, or net returns based on those data. Seldom is such field activity designed to measure and compare entire farming systems in terms of biological yield, economic return, energy efficiency, and impact on water quality and other environmental indicators. Students are infrequently afforded the opportunity to participate in such research, and rarely do we tap into the rich expertise available in the farming community to help educate students in practical farming systems. This project explores research, demonstration, and education on comparative farming systems for the future.

Five micro-farms were established for undergraduate students to gain research and practical experience in a whole farm context.
Student interns are comparing alternative management strategies for crop and crop/animal production in five systems: conventional crop rotation, diversified crop rotations, agroforestry with crops and woody perennials, organic cash row crop rotations, and beef production on forage, crop residues, and short feedlot period.

Objectives
Design and implement a one-year undergraduate internship in comparative farming systems that emphasizes hands-on experience in developing and implementing a management plan for a small-scale farm.

Develop a research/demonstration model for comparing the productivity, economics, energy use, and environmental impacts of five alternative farming systems for eastern Nebraska.

Establish baseline soil and crop monitoring to allow evaluation of trends and relative condition of the five farming systems.

Derive a series of alternative management strategies, educational and extension materials, and teaching tours of the farms for students, farmers, and the general public.

Results

A one-year undergraduate internship in comparative farming systems was designed and implemented with a group of four students. They participated in a three-credit seminar through the spring semester that included study of integrated farming systems, guest presentations by faculty and farmers about how to design systems to efficiently use land and resources, and exercises that led to design of their own specific management plans for each farm. The year-long activity was concluded with two students in the fall semester seminar. They prepared final reports on each of their farm's performance and extrapolated the results from the micro-farms to full size analog farms in eastern Nebraska. Economic results were summarized in terms of the full size farms.

We learned that recruitment of students for the microform internship program was a vital first step in the process. An intensive program of class visits and announcements, posters on campus, advertisements in the student paper, and personal letters of invitation to a sample of 100 junior class students with grade point average > 3.0 were all used for recruitment. We found that of all the methods used, the personal letters of invitation to an information session were the most effective. We had over 25 students attend the meetings, and most of them were in response to personal letters. In future years we will send letters of invitation to all junior class students with this grade point average or above, and will test the hypothesis that this will provide us with greater competition for the available positions for interns.

A full-color brochure will be published soon to be used for publicity and for attracting industry support.

Innovative Approaches to Practical Education in Sustainable Agriculture

Project Number:
LNC 92-47.1 (Continuation)

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Funding:
SARE: $98,094
Match: $81,748

Duration:
June 1994 - September 1996

Keywords:
Education/Networking/Extension

Abstract
We propose to continue and develop further an innovative approach to practical and applied education in sustainable agriculture that began with LISA/SARE support in 1992, in terms not only of its principles, but also its practices and systems. We propose to organize education programs which will provide agricultural students and young farmers with: hands-on practical educational projects; experiential training; on-farm educational programs utilizing innovative farmers around Ohio as hosts; and exposure to ideas and opinions on sustainable agriculture, from successful lower chemical input farmers, appropriate agricultural scientists and extension agents, members of environmental organizations, and agricultural policy makers.

The key program component will involve offering ten Competitive Scholarships annually to outstanding students, who have the potential to become tomorrow's agricultural leaders, to allow them to attend an intensive ten-week on-farm Sustainable Agriculture Internship Program co-sponsored by Ohio State University, the Stratford Ecological Center, and the Ohio Ecological Food and Farm Association (OEFFA).

Objectives
To provide innovative opportunities for practical education in sustainable agriculture for agricultural students and young farmers.

To provide and expand venues for educational opportunities in sustainable agriculture with practical hands-on experience, for agricultural students and farmers, through a state-wide network of publicly and privately operated demonstration farms.

To facilitate the further development of an association of Innovative Farmers of Ohio (IFO) to serve as a highly visible facility for practical student and young farmer education in sustainable agricultural practices and systems, particularly in providing venues for student experience.

Methods
We have specifically targeted students and young agriculturalists because we feel that these people will have the greatest impact as future agricultural leaders. We feel strongly that the innovative education program which we have proposed will have its greatest impact in the facilitation of technology adoption that is appropriate for lower chemical input sustainable farming systems.

Finally, by emphasizing practical education programs, we feel confident that we will produce agricultural practitioners who will be able to evaluate the strategies and materials of sustainable agriculture better and further develop economically competitive agricultural systems.

Student Internships: The Sustainable Agriculture Program at OSU will coordinate these programs in collaboration with the Stratford Ecological Center and the Ohio Ecological Food and Farm Association (OEFFA). We will educate 20 student interns who have demonstrated leadership potential, together with a strong interest in careers in agriculture and in the principles and practices of sustainable agriculture.

Demonstration Farms: In addition to an existing ODA/OSU Demonstration Farm and the Stratford Demonstration Farm, we will develop two others at Malabar State Park and the A.B.Graham Memorial Center and extend these to a state-wide network of at least 30 public and commercial demonstration farms.

IFO: We will continue to facilitate the development and activities of the new association, IFO, to include greater student participation through student membership, work and projects on IFO farms, and other IFO student activities.

Results

During the spring of 1993 we initiated a farmer-led association, Innovative Farmers of Ohio, dedicated to on-farm demonstration and research. This was founded by more than 40 innovative farmers who form our Farmer-to Farmer Mentor Program and who have adopted sustainable agricultural practices and systems successfully, and represent a wealth of knowledge and practical experience.

Sustaining Row Crop and Fine Hardwood Productivity Through Alley Cropping: On-farm Demonstration, Research, and Economic Evaluation of an Integrated Low-Input System

Project Number:
LNC 94-72

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Funding:
SARE: $123,948
Match: $72,737

Duration:
October 1994 - September 1996

Keywords:
Crop Production
Education/Networking/Extension

Abstract
The development of agricultural practices that minimize impacts on the environment yet remain profitable is a priority need of farmers. Alley cropping is such a system that provides these benefits yet remains an easy system to implement, requiring little additional knowledge, time, or skill from the farmer. This agroforestry system allows the farmer to cultivate crops as normally practiced with no additional machinery, and to tend tree crops as needed during slow times of the year. As such, the system is also flexible, allowing application to field windbreaks, to corners of fields that are not cultivated, to set-aside marginal lands, or to the banks and ridges of drainage ditches as well as normal cropping acreage. With the Central Region's continuing shift of timber management from public to private lands, and the importance of farm woodlots in the production of fine hardwoods for forest industry, alley cropping can provide an additional farm income while conserving soil and water resources, aiding pest control, and reducing fertilizer inputs.

Benefits of alley cropping are well documented and these benefits extend to systems where trees are planted in proximity to crops, such as field corners or ditches. One beneficial practice is mulching or green manuring where tree leaves from adjacent alleys are placed on the soil surface and/or incorporated into the soil. Yields of interplanted crops have been shown to increase as a result of mulching or green manuring

In addition to the direct benefits of mulching or green manuring using leaves from adjacent alleys, the tree alleys themselves serve important functions in regulating crop yield. Perennial trees have long been suggested as acting as nutrient "pumps," absorbing nutrients from deep in a soil profile and depositing these nutrients on the soil surface via litterfall or mulch for crop use in agroforestry systems.

Objectives
Evaluate the impact of tree alleys on crop yield and determine constraining biological processes characteristic to the Central Region.

Demonstrate the economic and biological viability of the alley cropping agroforestry system through technology transfer.

Validate research-derived economic projections on a practicing farm and determine parameters necessary for wider system adoption.

Outreach

Several publication avenues will be used to disseminate information to interested farmers. Several of the project investigators regularly contribute to extension newsletters and periodicals such as the *Indiana Prairie Farmer*, *Tree Farm Magazine*, *Woodland Steward*, *Crop and Pest* newsletter, and others which have a significant circulation among farmers. These publications will be used to introduce the system concepts and benefits to farmers and extension personnel while scientific and economic journals will be used to disseminate this information to other investigators who may be able to add additional information to the database.

Other communication techniques will include radio, video, and television as well as slide presentations. Also, joint Purdue-DNR and FSA publications will be written for district foresters and county FSA/NRCS personnel, including training modules and computer software instruction packages that contain the system comparisons and economic evaluations of the databases. These will enable a more uniform forestry-agronomy approach across the state and subsequently across the region. All project investigators will be involved in outreach efforts and will form a Response Team providing expertise for fielding farmer questions on system biology; crop, tree, and soil management; and economics. This panel will serve as a Purdue resource but will also be active at State Fair exhibits on LISA, at regional alumni events, with alternative agriculture societies, and at computer software/hardware demonstration shows for farmers. Outreach success for each media type will be evaluated by pre- and post-event surveys within the targeted populations. These will be followed by ground checks to determine actual implementation. While not all of these media events/efforts can be conducted during the first two years of the project, we expect to continue efforts in subsequent years.

Production of a Videotape Series Demonstrating Improved Grazing Practices to Promote Forage-Based Livestock Production in the Upper Midwest

Project Number:
LNC 94-71

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Funding:
SARE: $19,200
Match: $55,238

Duration:
October 1994 - September 1996

Keywords:
Education/Networking/Extension
Livestock Production

Abstract

Although incorporation of forages in farming systems results in less soil erosion, less water pollution and greater wildlife habitat than row crop production, the profitability of forage use must be equal or greater to that of row crop production in order to increase their use in farming enterprises. Considerable research has demonstrated that the profitability of forage-based livestock production systems would be significantly improved by the improving grazing management practices both during the summer and winter. Because the best management practices for an individual farm is site specific, training producers improved grazing management can not be done with single specific set of steps as readily as row crop production. Instead producers need a general set of guidelines with which they can manage differently depending on the annual variations in environmental and economic factors on their own farm. Videotapes provide a valuable means of demonstrating improved farming practices. Although several videotape series demonstrating improved grazing practices have been developed in other regions of the country, few series are available in the upper Midwest. Furthermore, while these series have emphasized the economic and environmental benefits of improved grazing practices, few of the series that are currently available demonstrate the technical considerations in managed grazing. Therefore, it was the objective of this work to develop a videotape series demonstrating improved grazing practices particularly applicable to forage species and environmental conditions found in the upper Midwest. A 5-tape series of videotapes was developed demonstrating managed grazing practices.

The first tape, "Introduction to Managed Grazing," initiates the series by discussing the importance of ruminant livestock to the Iowa economy, the benefits of incorporating grazing into farming enterprises and the advantages and disadvantages of utilizing controlled grazing practices. The second tape, "Pasture Plants," describes methods of improving pasture productivity by considering the effects of grazing intensity on photosynthetic capacity through leaf area and nutrient absorption through root growth and the habit and management of growth in forage species found in Midwest pastures. The third tape, "Animal Management," describes the technical aspects of managing a controlled grazing system including the determination of stocking rates and the size, number, shape and placement of paddocks needed to optimize the profitability of different livestock enterprises. Additional considerations discussed in this tape include the placement of watering systems, gates and milking facilities, management of reproduction and internal parasite control to optimize management in a controlled grazing system.

The fourth tape, "Fencing and Watering Systems," describes the options in fencing and watering equipment currently available and the considerations in the to make use of this equipment in the establishment of the optimal controlled grazing system for an individual farming enterprise. The final tape, "Year Around Resource Management," describes the productivity and nutritive value of forage resources available for grazing in the different seasons of the year and systems to match the numbers, genetics and management of beef cows, beef stocker steers, dairy cows or ewes with the forages available for grazing in each season of the year to optimize profitability of these enterprises.

Results

Information on these improved grazing practices has been presented to producers at field days on research and private farms, in workshops and in extension publications. The information presented through these mechanisms generally relates to individual topics rather than integrated systems. Videotapes can be used to demonstrate the principles of complex processes and technologies associated with grazing and with the appropriate print materials allow a producer to design the grazing system best-suited for his own operation. Furthermore, because surveys have shown that many farmers dislike or don't have time to attend extension meetings and field days, the use of videotapes as a technology transfer allows producers to study improved grazing practices at his or her own pace at home. Topics which need to be covered in a videotape include: the advantages and limitations of controlled grazing management, plant defoliation management at different grazing intensities and its relation to plant succession, alternatives for fencing and watering systems, paddock layout, management of animals in grazing systems and winter grazing systems for ruminant livestock. Because of the magnitude of the subject of grazing management, presenting this material as a videotape series from which the audience may selectively view specific subjects should be more effective than a single videotape covering all subject matter. Although this series was prepared for use by the individual farmer, it is anticipated that the series will be used in the programs of extension agents and in vocational agriculture and undergraduate college classes.

Economic and Ecological Analyses of Farms and their Component Practices to Promote Crop Rotation and Cover Crop Systems

Project Number:
LNC 94-70

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Farmer (15) cooperators from the Innovative Farmers of Ohio

Funding:
SARE: $117,670
Match: $126,840

Duration:
October 1994 - September 1996

Keywords:
Crop Production
Education/Networking/Extension

Abstract

On-farm trials have been receiving increasing attention as a means to encourage farmer participation in research and education. The use of on-farm experimentation to develop and demonstrate innovative practices has played a central role in promoting sustainable agriculture. The practical results from on-farm trials have encouraged innovation by farmers which has led to less dependence on purchased inputs. Importantly, on-farm experimentation is an empowering process for farmers because the results provide specific, reliable information for management decisions. Also, on-farm research can strengthen farmer-research collaboration and provide unique opportunities for researchers to collect basic scientific information under a wide range of management and geographical conditions. We will use replicated trials in the proposed project to research, demonstrate and encourage the adoption of diversified cropping systems.

Through collaboration between Ohio State University and the Innovative Farmers of Ohio, the proposed project will research and develop field crop diversification involving rotations and cover crops. Our two-fold approach for promoting these practices is to combine on-farm component research providing the precision of factored, replicated experiments and whole farm systems analyses providing overall ecological and economic contexts. During the past three years, we have been carrying out in-depth analyses of farms managed under long-term sustainable management. This past year, in conjunction with a newly organized farmers' research and education association, the Innovative Farmers of Ohio, we have begun on-farm component research targeted on sustainable practices. Based upon our experiences with whole farm analysis and component research, we now propose to combine these approaches to encourage diversified cropping systems identified as priorities by participating farmers.

Crop rotations and cover cropping were chosen as the focus for this project because these practices are central role in sustainable farming through increasing enterprise diversity, reducing purchased inputs, and conserving soil and water resources.

The trials, conceived and executed by 15 farmer-cooperators in conjunction with OSU researchers and Extension, will generate statistically reliable information on specific management practices related to rotations and cover cropping, including soil fertility, weed management, crop combinations, and tillage. A whole-farm system approach, conducted through analyses of nutrient and energy flows, economics, and farmers' traditional knowledge and quality of life information, will establish the context for designing and interpreting component research results.

With this approach we will document the impact of diversification at the whole-farm level.

The outreach objective of the project will facilitate information exchange through participatory field days, workshops, focus groups and farmer-to-farmer mentoring.

Objectives
Develop a participatory on-farm component research program to promote diversification through crop rotations and cover cropping.

Conduct whole-farm ecological and economic analyses that combine scientific information and farmers' experiences to provide the context for component research.

Facilitate information exchange among farmers focusing on principles of economic sustainability and environmental conservation.

Evaluation
At the beginning of the project, a baseline survey of the farmer cooperators will be conducted to determine the level of enthusiasm, motivation, resources and commitment cooperators bring to the project. Similar surveys conducted mid-way and at the end of project will indicate the extent to which the project contributed to the farmers' development. An important criteria here will be the degree to which the farmers' perceive that the project's activities contributed to their long-term survival on their farms. Completion of objectives, dissemination of project findings and attendance at field days and workshops also will be used as criteria to evaluate the project's success. Surveys of the general community attending field days and workshops will also be used for evaluation and a means for improving future outreach activities.

The Role of Soil Management in Crop Nutritional Quality and Susceptibility to Pests

Project Number:
LNC 94-69

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Funding:
SARE: $95,232
Match: $153,595

Duration:
October 1994 - September 1996

Keywords:
Soil/Water

Abstract

Proponents of organic farming have long contended that their methods of soil management lead to healthy crops that have higher nutritional value and greater resistance to insects and disease than crops grown using high-chemical fertility. Although these reports have been largely anecdotal, recent studies by our group and others have supported the idea of lower pest susceptibility in organically managed crops, while the effects of different soil-management systems on crop nutritional quality remain largely unexplored. Although mineral nutrients are recognized to play an essential role in plant health, health is usually measured by the sole criterion of plant yield. When soil-fertility recommendations are based only on avoiding nutrient deficiencies that limit yield, there is strong incentive for farmers to apply more fertilizer than necessary since the only perceived tradeoff is the cost of fertilizer. The primary objective of the proposed research is to establish a more holistic view of soil management, requiring an expanded concept of plant health, termed "inclusive plant health," which also includes the qualitative parameters of nutritional quality and resistance to insects and disease. Demonstrating the effects of mineral imbalance and other aspects of soil management on the qualitative parameters of plant health will encourage a more ecologically suitable approach to soil fertility.

To understand the interaction of soil management and inclusive plant health, we shall use the complementary approaches of on-farm research and controlled greenhouse experimentation. Initial whole-farm and greenhouse studies will demonstrate how nutritional quality and pest susceptibility differ between crops grown under organic and conventional management, while subsequent empirical studies will help to establish the mechanisms underlying this interaction. The project represents a collaboration between an interdisciplinary team of researchers (Entomology, Agronomy, Plant Pathology, and Dairy Science) and farmers who use different fertility management practices. Farmers will provide soil for greenhouse experiment and records of fertility and pesticide inputs, and they will allow surveys of pests on their farm. In addition, they will provide experiential knowledge that will be used in deciding management variables to be tested and will act as scouts for pest outbreaks in fields other than those being surveyed.

Objectives
Compare levels of corn pests and crop nutritional quality on conventional and low-input farms.

Measure the effects of soil-management history and form of fertilizer on inclusive plant health.

Establish optimal nutrient ratios and levels for maximizing inclusive plant health.

Determine effect of soil microbial activity on plant qualitative measures..

Results
In short, depending on the specific outcomes of these studies, we expect the work to lead to: 1) reduced dependence on pesticidal intervention, thus reducing environmental contamination, farm worker exposure, and residues on food, 2) reduction in the use of inorganic fertilizers, 3) easier transition to LISA with regard to insect damage, 4) lower off-farm inputs, and 5) potentially improved crop nutritional value and herd health. In total, these benefits will improve farm profitability by reducing purchased inputs and encouraging better use of farm resources.

Outreach
Findings will be disseminated primarily through state-wide farmer organizations, and the publications of the OSU Sustainable Agricultural Program. In addition, results will be used to assist farmers in conducting their own experiments in this subject area. In so doing, these farmers will become part of our outreach program, as their experiences serve to increase the interest and confidence of other farmers in changing their soil management.

We seek to combine farmer experiential knowledge and on-farm research with controlled greenhouse studies to build a systems view of soil management that includes crop quality and pest susceptibility.

We hope to reach farmers representing the full spectrum of fertility management. First, the work will address the questions of organic farmers who wonder why their crops are less susceptible to pests than those of their neighbors. Secondly, for the reasons explained above, we shall help those farmers interested in converting their farms to organic management. Thirdly, we recognize that for a variety of reasons not all farmers will be willing and/or able to convert to organic farming, irrespective of the benefits demonstrated. For these farmers, understanding the significance of balanced mineral nutrient on inclusive plant health will lead to more judicious use of inorganic fertilizers and/or greater use of manures, reduce the need for pesticide intervention, and potentially improve the quality of their animal feed.

Research findings will be disseminated to farmers through the Ohio Ecological Food & Farm Assoc. OEFFA, the newly founded but rapidly growing Innovative Farmers of Ohio (IFO), and the OSU Sustainable Agriculture Newsletter. OEFFA holds an annual state-wide meeting and several farm tours throughout the state, IFO plans to hold state-wide and regional meetings annually to discuss farmer- and university-directed research projects. We have participated in several such meetings and farm tours during the past two years. In addition, working through IFO, we shall assist farmers in designing and conducting their own experiments in this subject area.

Evaluating Soil Organic Matter and Soil Biology for Improving Short- and Long-Term Management of Soil Nitrogen Supplying Capacity

Project Number:
LNC 94-68

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Funding:
SARE: $93,500
Match: $48,545

Duration:
October 1994 - September 1996

Keywords:
Soil/Water

Abstract
This proposal requests SARE program funding to investigate the relationship between soil management practices, soil organic matter (SOM) characteristics and dynamics, soil biology and soil nitrogen (N) fertility. Our project is a collaborative effort between members of a newly formed grassroots farmers organization, Innovative Farmers of Ohio (IFO), and the Ohio State University. The collaborating farmers are participating in the identification, development and testing of innovative technologies and management strategies that optimize and reduce N fertilizer inputs. Their approach is to evaluate and use on-farm N resources more efficiently, and base the use of purchased N inputs on more complete information about SOM and its relationship to soil biology and soil N supplying capability.

This research will generate a better understanding of the biological basis for N fertility (both short- and long-term) present in all soils, and explore methods to evaluate and manage this fertility.

Objectives
Demonstrate the degree to which particulate organic matter is affected by management alternatives, including tillage and cultivation, cover cropping, animal manuring, and crop rotation.

Evaluate relationships between POM and soil biological activity.

Relate POM quality and dynamics to N dynamics and availability, and evaluate the utility of POM measurements in predicting soil N availability for crop uptake.

Methods
Demonstrate the degree to which particulate organic matter (POM) quantity and dynamics are affected by management alternatives, including tillage and cultivation, cover cropping, animal manuring, and crop rotation.

Evaluate relationships between POM and soil biological activity, relate POM quality and dynamics to N dynamics and availability, and evaluate the utility of POM measurements in predicting soil N availability for crop uptake.

Outreach

This project is inherently participatory, with collaborating farmers from IFO contributing significantly to the development of this proposal. All participants will take part in the evaluation of the results of this work. Evaluation of the project's progress will be made each winter by all participants at IFO annual meetings. Results will be shared through IFO field days, farmer-to-farmer workshops and newsletters, as well as through popular and refereed publications. The project's outcome will be evaluated in terms of the participating farmers ability to reduce fertilizer N costs through better evaluation, utilization and management of on-farm N resources.

Future Farmers in Sustainable Agriculture: a Participatory Examination of the Preparation Requirements for Competent Sustainable Agriculture Practitioners in the Twenty-First Century

Project Number:
LNC 94-67

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Organic Growers and
Buyers Association

MN Project

Sustainable Farmers Association

Northern Tier Consortium

Funding:
SARE: $20,800
Match: $14,550

Duration:
October 1994 - September 1996

Keywords:
Education/Networking/Extension
Quality of Life

Abstract

The average age of farmers is rising, the number of farmers is declining, and rural communities are disappearing. Fewer children of farmers choose to farm. These trends cannot continue if we are serious about making the transition to sustainable agriculture. Sustainable farming advocates foresee a need for more people on the land to manage diverse, environmentally sound, economically viable farming systems in the context of rural communities. But where will we find the people to be farmers in sustainable agriculture in the twenty-first century? What will be their responsibilities toward the land, their local community, society at large and the food system? What tasks will they perform, what competencies must they have, and how will they differ from conventional farmers of today? What should they know? What combinations of formal education, informal training, experience and philosophical orientation will prepare young people (perhaps of urban, ethic origin) to become farmers in sustainable agriculture and develop a quality of life that keeps them in farming? The Future Farmers in Sustainable Agriculture Project will seek answers to these questions.

The Minnesota Food Association (MFA) proposes to engage other sustainable agriculture advocates in a process of developing a job description for "farmer" in the context of twenty-first century sustainable agriculture and creating a prospectus for the preparation of people to become farmers. The process and resulting document are intended to broaden an understanding of the potential for sustainable agriculture to be a driving force in the development of rural communities and a contribution to an improved quality of life in rural areas. This is not a "beginning farmer" program, nor an effort to create university majors in sustainable agriculture. It is a program to envision the future we want and prepare for it. References in the literature to sustainable agriculture education reveal that most existing courses or programs are "about" sustainable agriculture, but not "in" sustainable agriculture.

MFA will undertake a three part research process that involves a literature search, interviews with individuals representing diverse roles in sustainable agriculture, and gatherings of small groups to exchange views about the farmer job description and prospectus for job preparation. MFA will organize focus groups within Minnesota the first year, then move out of Minnesota to hold symposia among North Central Region sustainable agriculture advocates in the second year. Information and viewpoints accumulated in the first year will be synthesized and summarized in a document to be presented to symposia participants for analysis and response.

At the conclusion of the second year, MFA will edit the accumulated results into a new document that represents a synthesis of the best ideas about the position of "farmer" in sustainable agriculture and how to prepare a person to fill that position. MFA will distribute the document widely and encourage its further reproduction and distribution.

The Minnesota Food Association proposes to engage a diverse group of sustainable agriculture interests in a process of describing the concept of "farmer" in the context of sustainable agriculture in the twenty-first century. The project will involve: a) synthesizing a job description; b) drawing up a set of recommendations for the preparation of persons who wish to live and work on a community-based, family-sized farm using sustainable practices, and; c) distributing research results as a "prospectus" publication which can serve as a vehicle for stimulating continuing dialogue and as a possible guide for the development of future educational policy and program strategies.

Objectives
Developing the Job Description.

Develop the concept of "farmer" in the context of twenty-first century sustainable agriculture and present it in the form of a job description that not only describes the work of the farmer, but also reflects society's expectations of those who care for the land and grow food in a sustainable way and also reflects quality of life expectations of the farmer as a member of a local community.

Develop a prospectus for the preparation of people to be farmers in sustainable agriculture. "Preparation" includes a broad mix of education and training, practical experiences, and competencies that provides the background for people to become farmers in sustainable agriculture.

Use the farmer job description and the prospectus for preparing future farmers as a means of broadening the discussion and acceptance of sustainable agriculture as an important force for development of rural communities .

Results
This project will result in a concrete product in the form of the prospectus. It will be evaluated by participants in the process of creating it and by readers of the published document. Special efforts will be invested in designing effective feedback mechanisms for use by prospectus readers and for incorporating that feedback in subsequent MFA publications including *At the Crossroads,* MFA's nationally-distributed land grant accountability newsletter.

Investigation of the Viability of Growing Herbs as Alternative Crops for Iowa Farmers

Project Number:
LNC 94-66

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Funding:
SARE: $50,260
Match: $10,500

Duration:
October 1994 - September 1996

Keywords:
Value-Added
Crop Production
Marketing

Abstract
The use of a process budget to analyze the breakdown of costs throughout the growing and processing of herb crops is an essential component in identifying viable crops. The use of one years data, of course, is not enough information to make final decisions on the viability of various crops but it indeed provides the necessary starting point to begin gauging profitability. Information on areas where greater efficiency is needed also can be gleaned from the process budget.

Three areas have been identified through the process budget where improvements can lead to greater profitability. The first area is reduction in the amount of labor used for weeding crops. This year weather conditions played a major role in this aspect, but it did help emphasize the need to remove as much of the weed population as possible by primary tillage *before* planting. The second area involves the need to make drying facilities more efficient.

Processing of herb crops made great strides in 1995. Essentially, movement was from no system to a nearly completed processing method for many of the culinary herbs in which the leaves need to be removed from the stems. This was a major hindrance for growers to overcome in order to move into the marketplace. Wholesale distributors require that herbs come to them in a nearly completed processed form.

Time and labor requirements may prove to be one of the more significant obstacles still needing some attention in trying to overcome. Planting of the crop will generally not be a problem, but weeding, drying and processing will require a significant amount of manpower later in the season. This is especially true if consideration is to increase acreage amounts.

Objectives
Examine crop plans to determine which crops are most conducive to reliable profits for Iowa farmers.

Determine which cultural practices provide optimum production of each crop.

Evaluate how herb production practices fit into current farm operations in two respects: a) time and labor requirements, and b) equipment needs and modifications.

Explore various marketing alternatives in the retail and wholesale trades.

Outreach

After the first of the year a series of three meetings were held with interested growers of the Iowa Producers Cooperative and other interested farmers. Attendance ranged from 15 to 25 growers for each meeting. Discussion primarily focused on working with Frontier Cooperative Herbs (FCH) of Norway, Iowa, to establish a working relationship and possibly develop some grower contracts for 1995. In consultation with FCH the growers developed a list of herbs that would be easy to grow and are in relatively high demand. For the initial season, FCH was reluctant to develop contracts for 1995 but were interested in purchasing any product that was produced and met their quality standards.

A field day was held on August 26 to share first hand the experiences of 1995 with interested growers. Leroy Ballard was a speaker at the field day, and he discussed what herbs are in demand from the medicinal market and various production practices used on his farm. I discussed the production practices used for the experiments established in 1995 and we then toured the plots and reviewed the equipment used for production of the crop. Twelve growers from around the state attended the field day, participating in lively discussion between interested producers.

Results

Farmer adaptation.

Six producers experimented with small acreages (< 0.1 A) in 1995. Success was variable from total crop failure (due to growing conditions) to some very excellent production of basil and dill. The three crops focused on by growers were dill, basil, catnip and echinacea. One producer had very good success in drying dill with his grain drying bin.

Processing.

Development of processing methods have taken great strides in our first year of experimentation. We were able to successfully dry all herbs produced this season with excellent quality maintained. Our primary focus for next year will be to make this a more efficient process. This will be elaborated on under the Process Budget heading .

The removal of the leaves from stems of various culinary herbs has been experimented on extensively this fall. Results have been very good with the use of a combine for this process. The threshing mechanism of the combine adequately removes all leaves and breaks up some of the stems. After this process occurred, though, it was quite apparent that a method for separating the leaves from the stems was needed. The combine was unable to adequately blow the leaves away from the stems as they traveled out the back of the combine.

Market Development.

A working relationship has been established with Frontier Cooperative Herbs (FCH) of Norway, Iowa. and Tones in Ankeny, Iowa. FCH agreed to buy any herbs that met quality specifications before the 1995 growing season. Problems occurred on the producer side with little production available for FCH. The need to store herbs until FCH was willing to take them was one consideration for farmers resistance. Samples have been sent to FCH and Tones. In the case of FCH, herb quality met their specifications but quantities were not there to make any sales. Tones has not sent out an evaluation of our samples to date. Herbs that have been processed recently will be sent to both companies to determine if they will meet specifications. Development of a satisfactory processing method on the farm is one of the biggest obstacles in doing business with these companies.

Quality of Life Effects of Conventional, Transitional and Sustainable Production Systems on Rural Communities and Family Farms in the Western Corn Belt

Project Number:
LNC 94-65

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Funding:
SARE: $37,786
Match: $26,920

Duration:
October 1994 -September 1996

Keywords:
Quality of Life

Abstract
Two objectives were identified for SARE project LNC 94-65, "Quality of Life Effects of Conventional, Transitional and Sustainable Productions Systems on Rural Communities and Family Farms in the Western Corn Belt." The project flowed out of data needs identified by a 1993 study of Nebraska farmers by an Agriculture in Concert with the Environment (ACE) project at the University of Nebraska. Four different farming systems were identified by the ACE project. They were an irrigated continuous corn system, no-till system, integrated system (smaller farms with both crops and livestock) and a near organic group characterized by minimal reliance on synthetic chemicals for either fertilization or pest control.

Two methodologies were proposed to carry out these objectives, qualitative interviews with farm household members and rural community residents and a quality of life survey. Work assignments completed in the first year of the project include: 1) organized a sample of interview respondents; 2) organized and met with a farmer panel which helped design interview guide; 3) designed and pretested interview guide; 4) farm household interviews; 5) selected communities for case studies of farm-community impact; 6) drafted quality of life survey construction, to be carried out in January; and 7) made preliminary analysis of local community histories and identification of key informants.

Objectives
Analyze the linkages of four different whole farm systems to surrounding communities.

Analyze how conventional, transitional and sustainable farms are perceived to influence local community well-being.

Results
Neither overall household income and nor percentage of household income coming from the farm varied significantly by farm system.

Members of the integrated and near organic groups were much more reluctant to borrow to expand or incorporate new technologies on their operations.

Ownership structure is complex in all of the farm systems.

Intergenerational transfer of the farm is largely unplanned and often results in intergenerational conflict over goals for the operation.

Two strategies are being used to bring sons back into the operation: expansion and intensification.

While members of all farm groups accept the importance of the rural community to the future well-being of agriculture, how that community is to be defined and the role it should play is a contested issue.

Most marketing of farm products and farm purchases continue to be made at the local level while household purchases are increasingly being made in regional centers.

Off-farm employment and volunteer activity vary over the course of the life cycle of the farm household and the farm.

A Biological Control Network for the Sweet Clover Weevil and Clover Root Curculio

Project Number:
LNC 93-62
ANC 93-19

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Funding:
SARE: $58,551
ACE: $35,849
Match: $47,702

Duration:
September 1993 - August 1995

Keywords:
Biological Controls

Abstract

This project has two overall objectives: to achieve biological control of pest, Sitona weevils, in sweet clover and alfalfa in the North Central Region; and to involve farmers directly in working with and disseminating the natural enemies that serve as biological control agents. The two pests are closely related species of weevils, the sweet clover weevil (*Sitona cylindricollis*) and the clover root curculio (*Sitona hispidulus*). The sweet clover weevil is a serious pest of yellow sweet clover (*Melilotus officinalis*), with feeding on the foliage by the adult weevil capable of causing stand reductions and in some cases complete stand loss. The clover root curculio is a pest of alfalfa (*Medic ago sativa*), and in this case it is feeding on the roots by the weevil larvae that stress plants and allow entry of plant pathogens, which results in reduced stand vigor and longevity.

Neither weevil species is native to North America. The Sitona weevil's main natural enemies, small, non-stinging parasitic wasps (parasitoids), are found in Eurasia but do not occur in North America. We plan to import two species of parasitoids that attack Sitona weevils, *Perilitus rutilus* and *Pygosfolus falcatus,* and to establish them in North Dakota and Wisconsin. Arrangements have been made with entomologists in Moldova to collect the parasitoids in Siberia and Moldova and have them shipped to the U.S. The collection sites were chosen because of similarities in climate and/or latitude with proposed release sites in the North Central Region.

We plan to raise the parasitoids in the laboratory and conduct simple experiments to learn their requirements and habits. We will then make limited field releases of the parasitoids in field cages, and if successful we will make open field releases of the parasitoids. Laboratory work will be conducted at North Dakota State University and the University of Wisconsin. In North Dakota, three farmers will be directly involved with NDSU entomologists in conducting the field component of the project, and in the process they will learn the basics of biological control.

In Wisconsin, the field component will be conducted by UW entomologists in collaboration with Michael Fields Agricultural Institute scientists.

The three North Dakota farmers, in conjunction with the Northern Plains Sustainable Agriculture Society, will take the lead in passing on their knowledge and experience in biological control to others via a farmer network. The farmers will ultimately be responsible for maintaining an ongoing biological control program, including distributing parasitoids from establishment sites to other areas.

Objectives

To achieve a significant level of biological control of two related weevil pests, the sweet Dover weevil (*Sitona cylindicollis*) and the clover root curculio (*Sitona hispidulus*) in the North Central Region.

To involve farmers in learning how to work with and disseminate the natural enemies to be used as biological control agents.

Method

We chose to collect Sitona parasitoids from two locations: Barnaul, Siberia (53 degrees N latitude) and Kishinev, Moldova (47 degrees N latitude). The reasons for choosing these locations involved climatic and photo-periodic similarities. It is imperative when introducing a natural enemy that every effort be made to ensure that the organism is adapted to the conditions into which it will be placed. Obviously climate is an important consideration. A less apparent but often important consideration is latitude (photo period), since insects often use day length to gauge the seasons and set their seasonal "clocks". The Siberian location is similar climatically to the Northern Plains (North Dakota), and Moldova is similar to, though milder than, Wisconsin. However, latitudinally Moldova is similar to North Dakota, whereas the Siberian location is at least 4 degrees further north. Thus, we do not know how the natural enemies will react to our conditions. The third reason for including Moldova was one of practicality. We have negotiated with entomologists in the Institute of Zoology, Moldovan Academy of Sciences, to collect, rear and ship parasitoids to us. We are confident of the abilities of these scientists. Prior to the dissolution of the Soviet Union, they had been employed in Kishinev by the Soviet Institute of Biological Control of Plant Pests. In addition, one of the entomologists has had extensive experience working with parasitoids of Sitona weevils.

Initially, we plan to work with two parasitoid species, *Perilitus rutilus* and *Pygostolus falcatus*, including a Siberian and a Moldovan population of each species. These species are the two most abundant parasitoids of Sitona in both Siberia and Moldova.

Sustainable Community Values Project

Project Number:
LNC 93-61

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Funding:
SARE: $101,000
Match: $119,480

Duration:
August 1993 - March 1996

Keywords:
Quality of Life

Abstract
Community Supported Agriculture (CSA) is a promising strategy for sharing among consumers and producers the risks and benefits of sustainable agriculture. With members paying the costs in advance, farmers can afford to use more ecologically sustainable farming practices. CSA's potential contribution to rural community development includes the creation of new opportunities for self-employment in agriculture that provide a predictable seasonal income to support small-scale farming efforts. All farms being studied involve people who have been enabled to enter farming through Community Supported Agriculture. The project will seek to document not only the "how to's" for the farmer, but also a process for educating extension agents, farm service providers and the general public about the benefits and potential problems in implementing a successful community supported agriculture venture

Objectives
Develop decision case studies at Philadelphia Community Farm based on a whole farm analysis of production and distribution systems. Analyze management and production tasks and economic impact of CSAs on local and regional communities.

Determine values and organizational foundations for economic and social effectiveness of CSA.

Identify in what ways the establishment of community supported agriculture has or can impact other local/regional efforts for sustainable agriculture.

Document and demonstrate community supported agriculture to interested farmers, consumers, Cooperative Extension personnel and others.

Method
The project will be addressed in 4 stages: 1) expanded evaluation of on-going production and financial aspects of Philadelphia Community Farm; 2) development of a general framework to expand this evaluation to additional farms in the second year; 3) development of integrated descriptive case studies of these farms combining on-farm production/financial evaluation, local community impact analysis, and CSA member survey analysis; and 4) development of a decision case study(s) addressing decisions currently facing Philadelphia Community Farm and other CSAs determined during the first year of the study.

The expended internal analysis of Philadelphia Community Farm will focus on the following aspects: monitoring and analysis of production records; member recruitment; cropping plans with respect to annual member needs and long-term ecological considerations, etc.; member allocation decisions; own, hired and volunteer labor management cost - price determination interface of these traditional business factors with the values of Philadelphia Community Farm.

This expanded analysis will then be presented to additional CSA farms identified during year one with the purpose of developing whole-farm analysis that builds on PCF's analysis, the needs of the additional CSAs and the project, and the availability of adequate farm records. The analysis will form the basis of integrated descriptive case studies of the CSA organizations. These studies will combine the values underlying the organization's formation with the production, marketing, and financial analysis, the impacts of these farms on local communities and economies, and the attributes and satisfaction of CSA members. These will serve as an important component of outreach materials for the project.

Decision case studies will also be developed for the CSA organizations. The project team will initially determine which decision(s) to address. An example might be whether CSAs should expand produce distribution activities beyond the growing season. The descriptive case material will form the basis for these decision case studies. Key people in the decision-making process will be interviewed, options will be identified and evaluated, and suggested decisions will be made. These decision cases should be useful not only in addressing the specific question but also in evaluating how values, ecologically sound production practices, and market place economies interact in CSAs.

An economic impact analysis will determine the initial and multiplied effects of community supported farm(s), both on a local level (economic value of the farm to the local community) and regional basis (economic value to the end-user of the product). The data generated will be developed consistent with the PLANETOR whole-farm data format.

Sustainable Community Values Project, Phase II

Project Number:
LNC 93-61.1

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Funding:
SARE: $55,000
Match: $53,220

Duration:
August 1993 - February 1996

Keywords:
Quality of Life
Marketing

Abstract
Community Supported Agriculture (CSA) is a fast-growing movement of farmers and consumers re-establishing partnerships in local communities. By emphasizing land stewardship and community revitalization, CSA offers producers and consumers the potential to exercise a new degree of control over the terms of food production, distribution, and marketing. This study seeks to document the potential for such a strategy to significantly improve the quality of life for both urban and rural people and communities in the Upper Midwest.

The success of a community farm requires new kinds of farming skills and knowledge. Not only do farmers need the ability to produce a diverse organic vegetables in the right quantity at the right time, but they also need "educating" and "community organizing" skills. Early pioneers in the CSA movement have had strong education and organizing backgrounds. Farmers often do not see these as educators or have the experience, time, or knowledge needed to create learning and social experiences for others. Bringing additional farms into our study will allow us to further elucidate the values, attitudes, skills, and strategies needed by CSA farmers and how these can be fostered. Are local CSA farms meeting farmers objectives for quality of life with respect to income, time and energy demands, and long-term security needs?

This study is farmer initiated and brings together farmers, scientists and educators to build upon the first two years of the Sustainable Community Values Project. Phase II will apply the research prototype already developed to a total of 15 farms, fine tuning earlier research questions, and documenting the changes needed to improve the quality of life for all participants. Utilizing a participatory case study approach, both quantitative and qualitative methods will be used in two clusters of farms around Minneapolis-St. Paul in Minnesota and Madison, Wisconsin. The information collected will be disseminated to farmers, educators, and consumers in the form of conferences, field trips and publications.

Objectives
Document the skills, knowledge and support needed by CSA farmers and explore options for how they can be developed.

Develop strategies for strengthening shareholder involvement in CSA farms.

Explore the relationships evolving among farmers, shareholders, and the land.

Describe and evaluate the growth of regional approaches to coalition building and collaboration among CSA farms.

Examine the relationship between CSA farms and their local communities. Determine how CSA farms can have a positive impact in such areas as economic development, farmland conservation, and environmental quality.

Strengthen the capacity for farmers, members, and supportive organizations to identify and solve problems related to CSA. Develop a participatory research team, made up of farmers, shareholders and academic researchers, to develop and disseminate practical knowledge on an on-going basis.

Methods

Preliminary data collection for this project has already been underway for two years. The final project will reflect more than three years of first-hand participation and observation of CSA activities. Data collection will follow a triangulation strategy in order to obtain the greatest possible depth of information (Krueger 1988). Consumer survey data collected over 3-5 years will be quantified and utilized to complement and cross check data generated through other investigative methods in the manner advocated by Denzin (1970), while participant observation (see Bogdan and Taylor 1975, Burawoy 1991, Geertz 1973), focus group interviews (see Krueger 1988, Patton 1986), and in-depth personal interviews with farmers and consumers will generate the majority of the data. In order to address the research questions set forth, the following analytic dimensions will be explored: shareholder, farmers, shareholder/farmer relationships, farm-to-farm relationships, and farm-to-community relationships.

Sustainable Agriculture Mentor Program

Project Number:
LNC 93-60

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Funding:
SARE: $77,000
Match: $53,000

Duration:
September 1993 - August 1996

Keywords:
Education/Networking/Extension

Abstract

The sustainability of the traditional agriculture production system is in question, but conversion to sustainable agriculture practices is not widespread. This bottle neck is not due to lack of sustainable practices and sustainable technology, but due to a lack of knowledge and experience by farmers in how to implement sustainable practices and technology.

A planning and coordination committee will be set up to implement the project objectives of establishing a mentoring program. It will be composed of representatives from University of Nebraska-Lincoln, Nebraska Sustainable Agriculture Society, Center for Rural Affairs, and farmers. The committee will meet as often as necessary to ensure satisfactory project progress.

The Nebraska Sustainable Agriculture Society will take the lead in recruiting and selecting prospective farm mentors who have expertise in implementing sustainable agriculture practices. Mentors will be recruited statewide. Additional input will be provided by the University of Nebraska-Lincoln and the Center for Rural Affairs to help find the farmer experts.

The University of Nebraska will take the lead on providing professional improvement education for the mentors. Mentors will be required to attend a teaching skill workshop before they can begin mentoring. In addition, a professional improvement fund will be created for the mentors. Mentors will be able to use these funds to improve their skills on an individualized basis. The University will also help the mentors by developing educational materials where needed.

The Nebraska Sustainable Agriculture Society will take the lead in developing a directory of mentors, their expertise, and providing the contact point to match mentors with the prospective farmer clientele. This service will be promoted in the press as well as to organizations that deal with potential farm clientele. The mentor program will target transitional farmers throughout Nebraska as the potential farmer clientele.

During year two we did not recruit any additional mentors but are adding mentors when a need exists, either through a contact and need from a mentor farmer or through a perceived gap in coverage, geographical or subject area. The handbook that was developed in year one is still in use, but we are working on revising and streamlining the forms and process.

Contact was made with the mentors from time-to-time to check on progress of the mentoring process and to inform them about professional improvement activities (meetings, farm tours, etc.). Some of the mentors took advantage of the professional improvement aspect of the project and some did not. As with all farmers time is one of the most limiting resources or constraints to attending educational activities.

Objectives
To create a mentoring program to help farm families implement sustainable agriculture practices and technology.

Evaluate the mentor program and share progress with others.

Results
Efforts on project publicity and promotion were increased in year two. This included newspaper articles and popular magazines (*Norfolk Daily News*, *The New Farm*, *Nebraska Farmer*, others). Project brochures were sent to all the major agriculture agencies (FmHA, NRCS, FSA, and Extension).

The project was also promoted at a number of agriculture meetings by UNL Extension and NSAS staff. Mentors were encouraged to give presentations at agriculture meetings, and some of them did so. Mentors were also encouraged to give farm tours that highlight their operations. Again, many of them did so.

The mentor program participated in two major conferences and helped sponsor three workshops where over 250 producers participated

Over five tours with over 100 farmers attending.

Beginning Farmer Sustainable Agriculture Project

Project Number:
LNC 93-59

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Fifteen Nebraska Farm Families

Center for Rural Affairs

Center for Holistic Resource Management

Funding:
SARE: $109,000
Match: $436,684

Duration:
September 1994 - August 1995

Keywords:
Quality of Life
Education/Networking/Extension

Abstract
The Beginning Farmer Sustainable Agriculture Project seeks to create a more sustainable future for agriculture by enhancing opportunities for beginning farmers to start farming using sustainable farming methods. Sustainable agriculture and beginning farmers are a natural fit. Beginning farmers are generally more open to sustainable farming than established farmers who have already made emotional, intellectual and financial commitments to conventional methods. The sustainable agricultural strategy of substituting hands-on management and skilled labor for capital and other purchased inputs offers opportunities for beginning farmers, who lack finances but have time and management ability, to build the equity needed to get started farming. This project is a cooperative effort between beginning farm families, local community leadership, the Center for Rural Affairs, the Center for Holistic Resource Management, the University of Nebraska Agricultural Economics Department and the Nebraska Sustainable Agriculture Society.

The project has organized beginning farm families into mutual-help networks in eastern Nebraska. A special advisory committee of beginning farm families has helped shape and guide the project. The project has supported and cooperated with beginning farm families as they practiced holistic farm management and applied sustainable agricultural practices in whole-farm strategies to get started farming. Specific support network activities included group meetings, short courses, informational workshops, construction workshops, farm tours, on-farm research and on-farm consultation with farm families. The project has gathered information for descriptive case studies of participating farm families who agreed to keep whole-farm records including finances, energy and chemical use, and other environmental measures.

Objectives
Provide educational support to mutual-help groups of beginning farmers.

Collect and analyze data from cooperating farm families on their start-up strategies.

Publish whole-farm case studies of farm-entry strategies for cooperating farm families and publish decision case studies of critical decisions in the farm entry process.

Disseminate the process and results of this project.

Results

Six local mutual-help groups of beginning farmers/farm families were organized in 1991 and 1992 and were known collectively as the Beginning Farmer Support Network. These groups organized their own meetings and met monthly to discuss holistic farm management, low-cost strategies to begin farming, alternative crops and practices, and enterprise options. Four of the groups ceased meeting after a year, due to lack of effective meeting skills within the group and due to lack of common goals and experiences to bind members together. The two longer-lived groups had cores of people who had attended a lengthy course together and had common interests and familiarity with each other. Additional group formation in three communities was attempted in 1994 based on this experience. These efforts included training sessions in goal-setting and financial planning, and workshops and farm tours on tillage options, grazing, and CRP land. These additional groups did not continue meeting after the initial series of activities. More success was apparent when staff provided support to young farmers who started their own groups.

The twelve families have completed three years of record keeping, interviews and measurements of farm finances, social values, and farm practices. A summary of the first year's information was presented to the Design/Evaluation Committee in 1993 for their review and was published in an Interim Report in early 1994.

As a group, these farmers were succeeding at becoming established farmers. Owner equity increased an average of 16 percent for the study group in 1992. The debt-to-asset ratio (comparing total debts to total assets) was 0.35 in 1992, which was identical to a group of established farmers in northeast Nebraska, while the six least indebted farmers of the study group had a ratio of 0.11. Farm income provided only one-third of total income for the study families, and nearly-all held at least one off-farm job to make ends meet. In contrast, non-farm income for established farmers in the area provided only one-third of family income. This demonstrates the need for diverse local economies to provide these off-farm jobs that allow beginning farmers to start farming. Difficulty in collecting accurate data has delayed analysis of 1994 data and summary information.

Outreach

"Udder Sense - Low-Cost/Sustainable Strategies of Resourceful Dairy Farmers" (July 1995). This publication by Larry Kercil and Shawn Gralla, previous BFSAP staff, details low-cost methods of entering dairying and producing milk. It profiles several dairy farmers, specific farming practices and their whole-farm systems for sustainable dairy production. Thirty complimentary copies were distributed to key individuals in the North Central SARE Region and to national publications for review.

"Beginning Farmer Sustainable Agriculture Project Interim Report" (February 1994). Results of this project's first year results of interviews and records from twelve beginning farm families were presented alongside the project design and implementation techniques. Over 100 complimentary copies were distributed to sustainable agriculture organizations, agriculture libraries, and key individuals nationwide. Over 350 additional copies have been requested by mail.

"Fit for a Pig - Low-cost Sustainable Strategies of Resourceful Hog Farmers." This publication focuses on low-cost hog production strategies suitable for beginning farmers. Forty complimentary copies were distributed to key individuals in the North Central LISA Region and to national publications for review. Nearly 850 copies have been requested by mail since the publication's release in 1991, including 50 following its citation in a 1994 article in a national publication on pasture hog production.

Videotapes of workshops. The Nebraska Sustainable Agriculture Society widely distributes videotapes of beginning farmer/sustainable agriculture workshops recorded under this project.

Special Farm tours. During the past year we have hosted or arranged tours for farmers from Lithuania, the director of a beginning farmer training center in California, high school FFA classes, and a national grazing consultant.

Annual Medics: New Legumes for Sustainable Farming Systems in the Midwest

Project Number:
LNC 93-58

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Funding:
SARE: $130,000
Match: $85,262

Duration:
September 1993 - April 1996

Keywords:
Crop Production
Weed Control

Abstract
Using on-farm and experiment station research, we evaluated the use of annual medics in cropping systems to smother weeds, supply nitrogen, and to enhance yield and quality of companion crops. Crops studied included corn, soybean, sugarbeet, and asparagus. Experiments were conducted in Minnesota, Wisconsin, Michigan, Iowa, Illinois, and Ohio. Our project is a cooperative team effort with producers who plan and review the research findings. Consequently, a diversity of experiments was conducted with modification based on individual producer goals, equipment, and cropping systems. Medics were broadcast and band seeded into corn and soybeans and were intercropped with small grains. Moisture and temperature conditions during medic establishment had a major effect on medic germination and stand establishment and medic ability to compete with weeds. At many sites across the Midwest, dry soil conditions at seeding reduced medic stand establishment and their effectiveness as intercrops. Vigorously growing medics can supply N and compete with weeds but also have the potential to compete with companion crops. In smother crop systems with soybean and corn, medic competition with the crop can be reduced by altering the timing of medic and crop seeding, band seeding, and by varying the soil fertility.

Objectives
To evaluate annual medic based cropping systems as alternatives to conventional Midwest cropping systems.

To develop educational programs promoting integrated cropping systems that include annual medics.

Results
Following is a listing of results from on-farm and experiment station research. As described in our original proposal, we looked at several systems for incorporation of annual medics into cropping systems. Crops included small grains, corn, soybean, sugarbeet, and asparagus. Medics were seeded by broadcasting over entire plot areas and banding over crop rows. Our results cover several states and many environments but the following general summary provides an overview of the results:

Moisture and temperature conditions during establishment had a major effect on medic germination and stand establishment and medic ability to compete with weeds. At many sites across the Midwest, dry soil conditions at seeding reduced medic stand establishment. Therefore, a preliminary conclusion is that producers who use this technology will have to appreciate the risk associated with this system and be prepared to use alternative practices when appropriate.

Vigorously growing medics can supply N and compete with weeds but also have the potential to compete with companion crops. In smother crop systems with soybean and corn, medic competition with the crop can be reduced by altering the timing of medic and crop seeding, band seeding, and by varying the soil fertility.

Two annual medic species (*Sava, M. Scutellata and Santiago, M. Polymorpha*) were established in replicated corn plots. The medics were established both by companion seeding in which corn was planted in 30 inch rows and medic was drilled uniformly over plots on the same date; and by broadcast interseeding of medics following the second cultivation of corn. In both treatments, no chemical weed control was used. No mechanical weed control was used for the companion seeded plots. Corn plots for the interseeded treatments received two rotary hoe passes and two cultivations. The control treatment consisted of corn conventionally planted (no medic), which received herbicides plus cultivation for weed control.

Results of the establishment of annual medics into corn reduced corn grain yields compared to conventionally planted corn. Corn grain yield was lowest in the companion seeded treatments, and only slightly reduced when the medics were interseeded following last cultivation. There was no difference between the two medic species in their affects on corn yield.

Observations indicated that both medic species provided early growing season weed suppression, when companion seeded with corn, but allowed a flush of broadleaf weeds to establish later in the season. Yield reductions were probably due both to weed and medic competition with corn seedlings. Since 1993 was a particularly wet and cold season, the corn plants were very slow growing.

Both methods of medic establishment were successful in providing good fall cover. The ground cover following corn harvest in mid-October was visually rated at about 75 percent for both medic species and both methods of establishment.

Improving Nitrogen Utilization with Rotation and Crop Covers

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LNC 93-57

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Funding:
SARE: $93,799
Match: $121,226

Duration:
September 1993 - August 1995

Keywords:
Soil/Water

Abstract
This project provided concrete evidence from 18 paired comparison farms, from detailed trials on a single farm and from experiment station trials that corn, soybean, wheat and cover crop rotations were superior to continuous corn. The return over variable costs was $84 per acre for continuous corn and $103 per acre average for the multi-crop rotations, a 23 percent increase in farmers' fields. The increase was similar for experiment station trials, with most of the advantage coming from increased corn yield and profitability in the rotation. Introducing wheat into the rotation, particularly when clover was used following wheat, gave the greatest increase in corn yield. Farmer corn yields increased from 115 to 134 bushels with rotation. In experiment station trials in the third year of rotation the 1994-95 averages were 174 bu/A with rotation and cover, and 159 bu/A without rotation or cover. Linear program analysis of the farm data using PLANETOR-derived values showed that phosphorus runoff could be held below 8 lbs/A per year and nitrate leaching below 40 lbs/A per year. Without loss of profit using rotations, leaching losses of nitrogen were reduced by 50 to 60 percent in the experiment station trials. The nitrogen credit for corn was measured at 60-70 lbs/A following wheat with clover, but the 15-18 percent increase in corn yield following this combination was due apparently to a combination of nitrogen and other yield-influencing effects. Soil quality differences were difficult to measure uniformly across the wide variation in soil types of the farm studies. No decrease in physical, biological or chemical quality was found with high crop diversity in any comparison, and increases were seen in soil carbon, water infiltration and nitrogen mineralization on some farms. Farmer response to these results in field days and in numerous training sessions has been excellent.

Objectives
To demonstrate that crop diversity of up to six selected species in rotation in four years will significantly enhance soil microbial biomass and activity.

To demonstrate that this diversity, when carefully arranged in rotation, may result in greatly enhanced soil nitrogen mineralization and availability early in the season and decrease soluble soil nitrogen by early winter. Leaching is expected to be dramatically reduced.

To demonstrate the degree to which these processes may be enhanced or disrupted by management alternative of compost or fertilizer and herbicides or cultivation.

To evaluate potential multi-year benefits from nutrient management by using enterprise budgets and tracking environmental quality parameters.

To establish a conceptual bridge between alternative and conventional management and to provide a sound basis for design of integrated crop systems.

Method

This project utilized a factorial experiment designed to separate crop integration effects. Long-term effects will be verified in long-established farmer fields, by using a paired-comparison methodology. Research will include measuring soil microbial biomass and activity, tracking soil nitrogen over time, detailed leaching studies, and an economic analysis that will factor in the costs of environmental impacts.

The impact of rotation of corn, soybean and wheat, including cover crops, was compared with continuous corn planting in south-central Michigan. Three studies were conducted as part of this research:

Eighteen farms along a transect from southwestern across south-central Michigan, covering eight counties, were paired for high and low crop diversity.

A detailed verification study of clover frost-seeded into wheat was done over two years on a single farm from this transect.

An intensive replicated rotation and cover crop study, the Living Field Laboratory, located along the defined transect, was monitored in its second and third year for comparative analysis.

On-farm Adaptation of Integrated Crop and Livestock Systems in Illinois

Project Number:
LNC 93-56

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Funding:
SARE: $92,994
Match: $229,620

Duration:
September 1993 - January 1996

Keywords:
Crop Production
Livestock Production

Abstract
The start-up year of the project has been an over-all success. The plots for the replicated studies were laid out and the treatments were established. Through the year innumerable lessons were learned about the logistical and technical problems associated with doing interdisciplinary research, from a distance, with the farmer playing an essential role, involving livestock, and producing a crop like alfalfa that does not have a conventional market.

In the case of the grazing study, the plots were planted in the Fall of 1993, fenced the following Spring, facilities for watering and handling (including periodic weighing) the cattle were set up, and the cattle were purchased and installed for the 1994 grazing season. The cattle did very well, but we believe we can do better as we learn how to better stock and manage an intensive grazing system and, perhaps, make other changes to more fully integrate beef production into mixed grain/beef systems. Opportunities exist to increase weight gain within the latter part of the grazing season with supplemental grain or with cool season forages grown as a second crop after wheat.

The lessons learned in the full-scale studies about doing research were primarily ones of learning what roles each of the participants has to play. An early management lesson had to do with how to manage and market hay on what remains a grain farm. Production this first year is felt to have been adequate, but with definite room for improvement as the management structure becomes settled and establishes a working understanding with the operators that will better handle the routine, leaving more time and energy to anticipate the unexpected and be sensitive to opportunities to learn and improve.

We are rapidly becoming acquainted with the issues associated with studying and actually managing more complex production systems. The experience of this first year has left an impression more of the opportunities involved than the difficulties.

Objectives
Conduct replicated small-scale experiments examining four alternative agricultural production systems involving various combinations of grains, hay, grazed forages, and beef cattle.

At the same time, adapt three of these production systems on an essentially full-scale basis, with 40 - 60 acres dedicated to each system.

Monitor, analyze and document environmental and economic consequences of all the production systems under study.

Sponsor annual on-farm demonstrations and exhibits, install signage for the benefit of farmers in the county and region, and interpret results in published research and cooperative extension education programs

Outreach
Even in the start-up year, the existence of the study site provided an opportunity for demonstrations and discussions related to sustainable agriculture and the work being undertaken at the site.

A workshop was held for about 25 farmers and farm managers on March 24, 1994. The agenda included introducing them to the studies that were being established at the site and visiting with them about their questions concerning the project as well as on-farm research of their own that they might be interested in.

A field day was held at the site on June 21, 1994. The program was aimed at introducing local producers to the concepts of sustainable agriculture. Discussions started with an explanation of research efforts underway on the study site. The agenda also included a presentation (and discussion) on monitoring soil health as well as a localized discussion of the wide range of practices that are consistent with the goals of sustainable agriculture. The county extension agent who organized the field day was very encouraged by the interest indicated by the attendance (including around 50 producers, the assistant director of the Illinois Department of Agriculture, and CES personnel from elsewhere in the state).

Economic and Environmental Implications of 1990 Farm Bill Sustainability Provisions in Water Quality Sensitive Areas

Project Number:
LNC 93-55

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Funding:
SARE: $82,650
Match: $64,500

Duration:
September 1993 - August 1996

Keywords:
Soil/Water
Socioeconomic

Abstract

The overall goal of the research conducted under this project has been to determine whether economic incentives offered by three environmental provisions which were part of, or introduced at about the time of, the 1990 Farm Bill are sufficient to induce farmers in environmentally sensitive areas to adopt sustainable practices and systems. The three provisions are: a) the Integrated Crop Management (ICM) cost-share program; b) the Water Quality Incentive Program (WQIP); and c) the Integrated Farm Management (IFM) program. The study area consists of nearly 100,000 acres and over 400 farms in three eastern South Dakota counties over the Big Sioux Aquifer; this is a USDA-designated "Water Quality Demonstration Project Area" where ground water quality is a critical concern.

Five case farms in the study area were selected for analysis purposes--one that has participated in the IFM program and four that have participated in either the ICM program or the WQIP. Crop enterprise and rotation budgets were developed for each of the five case farms. For the two ICM and the two WQIP cases, farming system profits were estimated "before" and "after" program participation. Nitrate leaching estimates also were made for the "before" and "after" scenarios. Additional possible *practice* and *system* changes were identified for each of the four farms, and both farm profitability and nitrate leaching estimates were made for each of those scenarios, as well. From these estimates, curves showing profitability/water quality tradeoffs and complementarities were developed for "typical", "wet", and "dry" climate conditions.

Results indicate that changes in at least some farming practices and systems could yield *both* increased farm profits and improved ground water quality. In three of four case farm studies, changes in farmers' practices associated with ICM or WQIP participation lead to increased profits (ranging from $6 to $30/acre) and very little change in nitrate leaching to ground water.

For all four case farms, there appears to be at least one additional practice or system change that could lead to increased profits *and* decreased nitrate leaching to ground water. Some practice or system changes would involve tradeoffs between farm profits and ground water quality, however. In those cases, difficult policy choices may be necessary where deterioration in water quality becomes critical. The results of this research help to illuminate the possible magnitudes of the tradeoffs.

Considering the *profitability, capital intensity, complexity, and risk* associated with the environmental initiatives examined in this study and with the practices and systems farmers are being encouraged to adopt, we conclude that: 1) operators of "large", "medium", and "small" sized farms may adopt several of the practice changes being promoted through WQIP and ICM; and 2) system changes under consideration are more likely to be adopted by operators of "medium" sized farms than by operators of "small" or "large" farms.

Objectives
Identify and describe the nature of initial Integrated Farm Management (IFM), Integrated Crop Management (ICM), and Water Quality Incentive Program (WQIP) participation by farmers in a critical ground water area of eastern South Dakota.

Develop whole-farm economic models for three to four typical farms in that area, and develop enterprise and whole-farm budgets for alternative farm plans that might be used on those farms to comply with IFM, ICM, and/or WQIP provisions.

Develop estimates of the effects on ground water quality of shifting to the alternative farm plans in Objective B, giving special emphasis to reducing the likelihood of nitrate contamination.

Determine economic and environmental effects--for typical farms--of participating in the IFM, ICM, and WQIP provisions of the 1990 Farm Bill, using the whole-farm models and estimates developed for Objectives B and C.

Determine what further changes may be needed in the federal farm program in order to induce adoption of sustainable farming practices and systems with potential to satisfy ground water quality objectives.

Extend results of the research on Objectives D and E to farmers and to policy makers.

Outreach
Ten papers based on the project were produced.

Five case studies of participating farms were produced.

South Dakota State University is teaming with North Dakota State University on a two-year training project using SARE Chapter III funds. Dr. Pflueger anticipates using some the material contained in the four Economics Pamphlets in that training during the second year, as well as in other possible County-level meetings this year and next.

Low-Input Beef Cattle Systems of Production

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LNC 93-54

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Funding:
SARE: $70,686
Match: $81,750

Duration:
September 1993 - November 1995

Keywords:
Livestock Production

Abstract
This research project involves growing-finishing beef systems and the interaction with corn tillage system. Ridge-till corn was developed and is being compared to conventional tillage as a source of cornstalks for wintering beef calves. Tillage system had little effect on calf growth. There was greater trampling in the furrows than in the conventional fields and therefore fewer grazing days. The calves did not affect the ridges. Corn production during the following cropping seasons were measured on grazed and ungrazed areas. Grazing did not impact corn production on either ridge-till or conventional systems. After stalk grazing, the calves were fed alfalfa hay until grass was available. The cattle grazed eight different pasture systems until early September or early November when they entered the feedlot for finishing on high grain diets. Red clover interseeded into smooth brome increased cattle gains and eliminated the need for nitrogen fertilization during one year, but stands could not be maintained. Rotating the cattle from brome to warm-season grass or to Sandhills range increased cattle gains. Allowing the cattle to graze brome regrowth, turnips, cornstalks, and rye during the fall increased the weight of the cattle entering the feedlot. Feedlot performance of the cattle was measured and economics calculated for the eight grazing systems. Systems with greatest forage gains were the most economical.

Objectives
Develop economical, forage-based, low-input-cost beef growing-finishing systems to enhance the environment.

Determine the effects of cattle grazing cornstalks on ridge tillage system and ridge tillage system on cattle grazing stalks.

Transmit information on low-input, economical beef systems to cattle producers through field days, reports and a multi-state symposium.

Methods
Objective 1. One hundred ninety two weanling calves were randomly allotted to treatments on December 3, 1993. The calves on all treatments grazed cornstalks (see Objective 2) until March 1, 1994. They were supplemented with high quality alfalfa hay plus a vitamin and mineral supplement. From March 1 until May 1, the calves received average quality alfalfa hay.

On May 1, the cattle were placed on their summer grazing treatments:

Continuous brome grazing to September 9 then to feedlot.
Rotational brome grazing to September 9 then to feedlot.
Rotational red clover/brome grazing to September 9 then to feedlot.
Brome/warm-season grazing to September 9 then to feedlot.
Brome/Sandhills range grazing to September 9 then to feedlot.
Sandhills range grazing to September 9 then to feedlot.
Continuous brome grazing to November 11 then to feedlot.
Brome/warm season grazing to November 11 then to feedlot.

Results

The red clover seedings were successful the first two years, probably because of abundant moisture during the spring. The third spring had less moisture and seeding was a failure. In addition, the first year seeding (1992) did not survive the winter of '93/'94, possibly because of root diseases following a cool moist summer of 1993. Therefore, the clover/brome treatment had less red clover than desired. Our goal was to have 50 percent clover in three of four pastures. We accomplished that in only one of the four pastures. The other two pastures had minimal red cover.

Cattle grazing the continuous brome to September 9 (1.63 lb/day) and to November 11 (1.69 lb/day) gained somewhat better than these treatments have produced in previous years (1.3 - 1.5 lb/day). Rotational grazing of brome (seven pastures, five days on each) had only a small effect on gains (1.71 lb/day).

The rotational brome served as the control for the red clover/brome. Even though the red clover seeding was less effective than desired, the cattle gained more on this treatment than continuous brome (1.87 vs 1.71 lb/day). This is encouraging and suggests that good cattle gains may be possible with good red cover seedings. In addition to providing better quality forage for the cattle, the red clover eliminates the need for nitrogen fertilization.

Rotating cattle to warm-season grass increased cattle gains (1.86 vs 1.63 lb/day). This emphasizes the value of complementing the cool-season grass (brome) with the warm-season grass.

Moving the cattle to Sandhills range gave better gains than continuous brome (1.94 vs 1.63 lb/day). Gains were similar between cattle moved directly to range (1.99 lb/day) and those moved from brome to range on June 13 (1.94 lb/day).

Late removal of cattle from pasture (November 11) was less successful than expected. The cattle on continuous brome gained 1.69 lb/day for the entire season and the brome/warm-season cattle gained 1.74 lb/day. Gain during the 63 day fall grazing season was only .85 lb/day. This emphasizes the need to develop better forage production strategies for grazing during the fall months.

The Adoption of LISA Techniques of Pest Management by North Central Fruit Growers

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LNC 92-52

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Michigan Blueberry Growers Association

Michigan Bee Keepers

Cherry Central

Cherry Cooperatives

Funding:
SARE: $42,410
Match: $48,370

Duration:
September 1992 - August 1995

Keywords:
Crop Production

Abstract
One of the main barriers to the widespread utilization of LISA techniques for pest control in fruit production is the necessity of passing through a period of transition. Growers expect that during this period they will experience a decrease in production, a rise in pest problems, and a reduction in income. These problems arise in part because, relative to other farming practices, LISA techniques appear "lumpy"; they are perceived by some growers as requiring simultaneous implementation as a total package rather than gradual and piecemeal adoption. Given this "all-or-none" perception farmers are reluctant to move toward LISA methods. The proposed research will determine whether multiple trajectories of transition are in fact feasible and potentially successful.

Those growers who do attempt to implement LISA techniques face another problem. Often it is difficult to obtain accurate information about specific aspects of LISA methods, or the information which is available is not specific to their area or crop. In this situation, farmers seek to adapt the general outlines of certain methods to the specific conditions of their operations. But in doing so, they sometimes alter the practice of the technique to such an extent that either it will no longer be effective or it would not be classified as a LISA technique. A recent survey of fruit growers found that many described themselves as using integrated pest management (IPM) techniques, but from descriptions of their specific practices it was clear that their practices were not significantly different from conventional methods.

Both of these problems occur, at least in part, because models of successful transitions are not available to farmers. Growers who would like to move toward more sustainable techniques are not aware that others have successfully done so, and lack specific information about how their own operations might do so. The proposed project will identify models of successful transitions in fruit production in the North Central region. These models will be publicized to growers and to extension agents who specialize in fruit in the form of transitional guidelines which are incorporated into Cooperative Extension activities through IPM Schools, agent training and a "Fruit Transition" bulletin.

Objectives
To describe the actual transitions of fruit growers from conventional pest control methods to LISA methods by identifying:

1) The socioeconomic and production factors which caused growers to shift methods.

2) The process whereby growers shifted from conventional to LISA methods of pest control.

3) The factors which facilitated or impeded that shift.

To describe the current state of LISA methods of pest control by identifying the actual practices which growers are using for pest management under the rubrics of IPM, PPM and organic techniques.

To forecast the future state of LISA methods of pest control by assessing the economic, social and physical sustainability of growers current methods of pest control.

Method

In order to represent the variety of problems in making the transition to LISA methods of pest control for fruit production, three types of fruit will be selected. Apples are the largest crop in the region; tart cherries are representative of the stone fruits; and blueberries are a high value crop with large direct marketing.

The North Central region can be divided into three agroecological zones -- southern coastal, inland, and northern coastal. In each zone, four types of growers will be identified. The first group will be growers who are making a transition from conventional methods of pest control to IPM. The second group will be growers who have fully implemented IPM techniques. The third group will be growers who are making a transition to organic techniques or a similar regime of pest control, while the fourth group will be growers who have fully implemented such techniques. Analysis of the 1990 Michigan fruit survey showed that it was possible to distinguish these four groups. Since a large amount of information is available about growers using conventional techniques of pest control, a conventional group is not needed.

Personal interviews will be conducted with 72 grower cooperators to identify what pest control techniques are currently being used. Growers in the second and fourth groups will be asked to describe the process they went through to make the transition from conventional methods of pest control. Growers in the first and third groups will be asked what approach they are using in making their transitions. All of the groups will be asked what socioeconomic and production factors led to their decision to make a transition.

We view sustainability as composed of three dimensions: economic, social and biological. To assess the economic sustainability of the 72 operations, farm budgets will be calculated for each year of the study. To assess sustainability on the social dimension, attitudes toward resource conservation and levels of satisfaction will be measured both for the principal operators and for members of their families. Resiliency, diversity and energy subsidy will be assessed as the key parameters of biological sustainability.

Social and Cultural Factors Affecting Sustainable Farming Systems and the Barriers to Adoption

Project Number:
LNC 92-50

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Funding:
SARE: $72,018
Match: $58,037

Duration:
September 1992 - August 1995

Keywords:
Quality of Life

Abstract
A paired comparison of 60 farm families was employed (30 using sustainable systems and 30 using conventional systems) to determine why some families opt for sustainable practices, and their neighbors who resemble them in many ways do not. Although not a random sample the two groups do not diverge significantly along the dimensions usually expected to account for farming-system contrasts: age, education level, off-farm employment, farm size, soils or a representative field productivity. The paired groups, however, are distinctive socially. A whole-farm design was used that included the entire farm household. This approach brought to light factors other than profitability that effect whether sustainable farming systems are adopted, and whether once adopted persist through a transfer of management from one generation to the next. Families using sustainable farming systems had an environmental or health event linked to adoption, have traditions of environmentalism, systematically do on-farm experimentation and are generally prudent about resources in homes as well as in farming. Tractors are older, for example, and homes lack central air conditioning among the sustainable group. Findings indicate that rather than making a deep philosophical paradigm shift to environmentally sensitive farming (although not excluding it), sustainable families are characterized by a predisposition to use resources prudently in every dimension of their lives. Adoption of sustainable systems is therefore as much as for efficiency and financial motives as it is for environmental factors. Families farming conventionally, but sharing more characteristics identified with sustainable families, potentially are those best targeted for educational programs. Socially-sustainable situations (maintained through an intergenerational transfer) have long-term implications for whether adoption of sustainable-farming systems persists. Social sustainability in the long-term may rank as importantly for educators as achieving an initial shift from conventional systems.

Objectives
Determine the family and enterprise preconditions or barriers to adopting sustainable farm systems.

Identify and assess the environmental and economic consequences for the rural community of families farming with sustainable versus conventional systems.

Develop an innovative educational program that identifies the real-life costs and benefits to families using sustainable versus conventional farming methods.

Results

Distinctive social characteristics (arrived at inductively) were identified for the sustainable group: a family tradition of innovation; critical family events with environmental (or health) consequences; and family resource conservation and prudence patterns. About two-thirds of the sustainable group cited a negative environmental or health issue that triggered changes in how they farm. Over half the sustainable families reported a kin-mentor influencing their adoption decision. Furthermore, in four instances sons were influenced to return to the farm because of their parents involvement in ecologically sensitive farming. A majority (83 percent, a statistically significant number) of the sustainable parents felt good enough about the occupation to want their children to continue farming, in contrast to only 47 percent of conventional farmers. It may be that sustainable families obtain greater satisfaction from their farming-choices.

Prudence about all resources (agricultural, environmental or domestic) characterized the sustainable group of farmers. For example, 80 percent of the sustainable operators had extensive facilities to work on their equipment compared with 27 percent of conventional operators (significant at the .05 level). Each group had a comparable 3.7 average number of tractors. For the sustainable group, however, the average age of their tractors was 1974 compared with the average of 1980 for the conventional group (significant at the .05 level). Older tractors such as those owned by sustainable operators must be repaired often, and this group takes pride in keeping "antiques" operating. Sustainable families were less likely to have central air conditioning (47 percent) than conventional families (67 percent), significant at the 0.10 level. Lack of central air conditioning reflects an older home or a reluctance to invest in such equipment, another example of a prudent use of resources.

Sustainable families, we found, differ distinctively from those farming conventionally. Their farming changes during the last five years, their prudence with resources (e.g., how money was spent on the farm and in the home), and their awareness of differing from conventional farmers are all social/behavioral factors. We found a few conventional families that shared these characteristics. Such middle-ground farmers appear to be the most likely group to make a transition to sustainable farming systems. The purely conventional farmers, because of how they view the world and sustainable farming, seem unlikely candidates for conversion. Conventional families were highly critical of the flexibility and experimentation of sustainable adopters, and less respectful of their management than vice versa. Our findings point up the usefulness of targeting educational programs to audiences likely to accept them, and perhaps the futility of convincing all farmers of the worth of sustainable farming systems.

Evaluating Relative Impacts of Conventional and Sustainable Farming Systems on Rural Communities

Project Number:
LNC 92-48

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Funding:
SARE: $99,244
Match: $88,246

Duration:
September 1992 - December 1995

Keywords:
Quality of Life

Abstract

Farmers and community leaders from three communities, one each in Missouri, Nebraska and Minnesota, provided information for development, and validation of the conceptual and analytical models used for assessment of community impacts of alternative farming systems. Results of these studies focused on first-round or direct economic impacts associated with differences in resources, inputs, and outputs resulting from specialized, input intensive conventional systems compared with more diversified, alternative, or sustainable farming systems.

A detailed study of expenditure patterns of 30 farmers in southwest Minnesota indicates little differences in spending impacts on local communities between farmers who classified themselves as sustainable versus those who classified themselves as conventional. However, significant differences were found between large and small farmers and between crop farmers and those who had both crops and livestock. Smaller farms and farms with livestock had significantly greater positive impacts on the local economy than did their larger, more specialized counterparts.

A similar survey was carried out in the Hartington and Wynot communities in northeastern Nebraska. The Nebraska Study compares detailed economic data provided by 28 farmers, half of which were classified as "conventional" and the other half as "sustainable" based on current farming methods. The sustainable farms were found to be only about one-half as large as the conventional farms in terms of acres farmed, head of livestock, and total sales of commodities. However, the sustainable farmers actually reported a higher average farm income, or return over direct costs per farm, in spite of their smaller size.

The Missouri portion of the study was based on two alternative scenarios for returning land currently enrolled in the CRP program to agricultural production in Putnam County, Missouri. The conventional scenario was designed to reflect currently typical farming methods in north Missouri.

The alternative or sustainable scenario assumed increased use of crop rotations, input management strategies, and reduced tillage methods for cropping system and utilized planned, or management intensive, rotational grazing systems for livestock production.

Returning CRP land to crop and livestock production under either the conventional or alternative system would result in more than a two-fold increase in total direct, or first round, economic activity compared to current CRP payments. Total economic impacts under the alternative scenario were projected to total $7,860,000: $2,368,200 direct effects (excluding farm income), $925,700 indirect effects, and $4,565,000 induced effect (including farm income). This compares with $6,269,400 under the conventional farming scenario: $2,087,500 direct effects (excluding farm income), $776,000 indirect effects, and $3,406,000 induced effects (including farm income). Farm income could be expected to rise to $2.4 million and $3.4 million respectively for conventional and sustainable systems compared with $1.7 million in total CRP payments for the county.

Objectives
To facilitate community self-appraisal of the potential to increase local employment and income by supporting transitions of local farmers from conventional to more sustainable systems of farming.

To facilitate practical, community-specific evaluation of potential impacts of more sustainable local agricultural sectors on the overall long run sustainability of rural communities.

To promote an understanding and realization of potential positive linkages between sustainable systems of farming and sustainable rural communities; considering the economic, environmental, and social dimensions of sustainability.

Method
The Nebraska study focused in the communities of Hartington and Wynot which are located in Cedar County in northeast Nebraska and are dominated by moderate-sized diversified family farms. In June 1993, letters were sent to 42 farmers in the area, requesting their participation in a study of the relative impacts on rural communities of various types and sizes of farms. Follow-up phone contacts were made with each recipient and from this group, 28 agreed to participate.

A survey instrument was developed and sent to all participants. The survey requests specific information regarding the farmer's current operation, expenditure patterns, and future farming plans. To complete the questionnaire, each participant was visited in person so the interviewer could eliminate any deviations based on individual interpretations. These interviews were completed during 1993.

Results
The Minnesota study assessed differences in farm spending among various farm types by conducting in-depth interviews with 30 farmers in southwest Minnesota. The farmers were chosen from farm management associations so that a consistent set of records could be obtained. Interviewers spent approximately two hours with each farmer talking about their expenditure analysis and conducting a check-by-check analysis of farm expenses to determine which purchases were made locally and which were not.

The results of this interviews clearly show that as farms get bigger, they buy a smaller percentage of their inputs in local markets. The study also confirmed that the addition of livestock to crop farms increases local spending, but only up to a point. Very large livestock operations spend much more in total than their smaller counterparts, but have no greater impact on local economies because they have a much higher percentage of non-local spending.

Results of the full Minnesota study have been published as a MS thesis, "Local Spending Patterns of Farm Businesses in Southwest Minnesota," by John Wade Chism, University of Minnesota, September, 1993. The results of this study have been widely quoted in various newsletters and popular publications, a sample of which are enclosed with this report.

Innovative Approaches to Practical Education in Sustainable Agriculture

Project Number:
LNC 92-47.1

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Funding:
SARE: $98,094
Match: $81,748

Duration:
June 1994 - September 1996

Keywords:
Education/Networking/Extension

Abstract
We propose to continue and develop further an innovative approach to practical and applied education in sustainable agriculture that began with LISA/SARE support in 1992, in terms not only of its principles, but also its practices and systems. We propose to organize education programs which will provide agricultural students and young farmers with: hands-on practical educational projects, experiential training, on-farm educational programs utilizing innovative farmers around Ohio as hosts; and exposure to ideas and opinions on sustainable agriculture, from successful lower chemical input farmers, appropriate agricultural scientists and extension agents, members of environmental organizations, and agricultural policy makers.

The key program component will involve offering 10 Competitive Scholarships annually to outstanding students, who have the potential to become tomorrow's agricultural leaders, to allow them to attend an intensive 10-week on-farm Sustainable Agriculture Internship Program co-sponsored by Ohio State University, the Stratford Ecological Center, and the Ohio Ecological Food and Farm Association (OEFFA).

Objectives
To provide innovative opportunities for practical education in sustainable agriculture for agricultural students and young farmers.

To provide and expand venues for educational opportunities in sustainable agriculture with practical hands-on experience, for agricultural students and farmers, through a state-wide network of publicly and privately-operated demonstration farms.

To facilitate the further development of an association of Innovative Farmers of Ohio (IFO) to serve as a highly visible facility for practical student and young farmer education in sustainable agricultural practices and systems, particularly in providing venues for student experience.

Methods
We have specifically targeted students and young agriculturalists because we feel that these people will have the greatest impact as future agricultural leaders. We feel strongly that the innovative education program which we have proposed will have its greatest impact in the facilitation of technology adoption that is appropriate for lower chemical input sustainable farming systems. Finally, by emphasizing practical education programs, we feel confident that we will produce agricultural practitioners who will be able to evaluate the strategies and materials of sustainable agriculture better and further develop economically competitive agricultural systems.

Student Internships: The Sustainable Agriculture Program at OSU will coordinate these programs in collaboration with the Stratford Ecological Center and the Ohio Ecological Food and Farm Association (OEFFA). We will educate 20 student interns who have demonstrated leadership potential, together with a strong interest in careers in agriculture and in the principles and practices of sustainable agriculture.

Demonstration Farms: In addition to an existing ODA/OSU Demonstration Farm and the Stratford Demonstration Farm, we will develop two others at Malabar State Park and the A.B.Graham Memorial Center and extend these to a state-wide network of at least 30 public and commercial demonstration farms.

IFO: We will continue to facilitate the development and activities of the new association, IFO, to include greater student participation through student membership, work and projects on IFO farms, and other IFO student activities.

Results

During the spring of 1993 we initiated a farmer-led association, Innovative Farmers of Ohio, dedicated to on-farm demonstration and research. This was founded by more than 40 innovative farmers who form our Farmer-to Farmer Mentor Program and who have adopted sustainable agricultural practices and systems successfully, and represent a wealth of knowledge and practical experience.

Substituting Legumes for Fallow in U.S. Great Plains Wheat Production

Project Number:
LNC 88-10.1

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Northern Plains Sustainable Agricultural Society

Nebraska Sustainable Agricultural Society

Funding:
SARE: $113,000
Match: $113,150

Duration:
September 1992 - January 1995

Keywords:
Crop Production

Abstract
A collaboration among three state universities, three non-profit farmer organizations, and more than a dozen individual farmers, the goal of this project is to discover legumes and crop/legume systems which will effectively substitute for black and chemical fallow in the Central and Northern Great Plains. Of the 42 legume species evaluated to date, yellow-blossomed sweet clover, hairy vetch, foxtail dalea, and black lentil have shown the greatest immediate promise to create true 'green' fallow production systems. Current barriers to adoption of green fallow have been: 1) developing systems which reduce the vulnerability to excessive soil water depletion, 2) relatively low-cost and adapted legume species to use, 3) crop rotations that allow reliable and cost-effective establishment of legumes, and 4) sufficient knowledge and demonstration of promising systems to both the institutional (research, extension, consultant, and conservation communities) and general farming public.

In the past year, this project has sought solutions to each of these obstacles: 1) Alternative legumes and management approaches have been found effective in transforming evaporative and leaching water loss (from black and chemical fallow) into transpirational water loss (through green fallow) at all but the driest of environments within the targeted region. Only in south and west central Kansas have green fallow systems yet to be developed which sufficiently conserve water for recropping; 2) Sweet clover remains the most widely used legume because it is inexpensive and readily available seed. Other legumes, such as black lentil, are also becoming available commercially. Both hairy vetch and foxtail dalea will require less expensive seed sources before being widely adopted. 3) the development of a wheat/sunflower/green fallow rotation holds promise in both the spring and winter wheat regions as a reliable and cost effective rotation to promote soil and water conservation; and 4) demonstration and dissemination of this project is being conducted through three non-profit organizations.

In addition, the project sponsored a conference in October of 1993 targeted at state research, extension, and conservation staff to better acquaint these public institutions of the progress made in developing feasible green fallow systems for the Great Plains.

Objectives
To demonstrate and conduct on-farm research of a cereal/legume production system in the spring and winter cereal regions of the U.S. Great Plains.

To determine through exploratory small-plot research the suitability of alternative legumes in cereal/legume production systems and then develop management systems including other locally adapted crops, and livestock, to substitute for fallow in the spring and winter wheat regions of the U.S. Great Plains.

Using cost/return data generated in legume and system comparison studies, compare both wheat enterprise and whole-farm budgets for conventional fallow versus alternative legume production systems.

Results

This project has established viable green fallow production systems for the Northern Plains spring wheat region and a wheat/sunflower/green fallow system for both the Northern and portions of the Central Great Plains region. As compared to the traditional crop production systems in these regions, the green fallow systems reduce dependency upon nitrogen fertilizer, increase and extend the period of adequate surface cover to prevent wind and water erosion, build soil quality, and increase biodiversity across fields and landscapes which prevent pest and disease outbreaks. Specific results by location can be found in the recently complied conference proceedings.

In both North Dakota and Nebraska, the non-profits have taken the lead in organizing and conducting on-farm research of various specific components of locally adapted green fallow systems. In North Dakota, alternative legumes such as hairy vetch are being experimented with on-farm to establish reliable systems of seed production. Local production and distribution of the legume seed needed for green fallow would decrease overall costs of the system. Also in North Dakota, more than a dozen farmers are actively helping spread wider adoption of various green fallow techniques including the interseeding of sunflower and the use of spring-planted grain legumes. In the winter wheat region, Nebraska farmers and researchers are developing equipment to aid establishment of interseeded legumes in row crops. Though equipment was developed, due to the unusual weather of 1993 no demonstration plots were able to be established. In 1994, a coalition of non-profit, university, and oilseed crushing industry representatives are planning a series of on-farm demonstrations of the wheat/sunflower/green fallow cropping system.

Rotational plots continued in each of the three states to further gather legume growth, nitrogen cycling, and wheat recropping data. In addition, the project has begun a cooperative venture with NRCS to evaluate the erodability of soil from farms practicing green fallow versus neighbors that don't. Monthly surface soil samples are being gathered across the Plains and compared at the NRCS Big Spring, Texas, lab for their vulnerability to erosion. These data should help expand the inferences about the impact of green fallow systems on the environment across the Plains as a whole.

Preliminary analyses have shown certain green fallow systems economically competitive with both black fallow and continuous cropping. Additional specific results are attached and found within the conference proceedings.

Outreach

Local field days, winter extension-type meetings, and various news articles in the popular press were the principle means of dissemination during the past year. In addition, a conference was held in Rapid City, South Dakota, on October 25/26, 1993 targeted at the research, extension, and conservation community .

On-Farm Research and Demonstration of Ridge Tillage for Sustainable Agriculture

Project Number:
LNC 92-44

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Funding:
SARE: $75,867
Match: $85,489

Duration:
September 1992 - August 1996

Keywords:
Education/Networking/Extension

Abstract

Practical Farmers of Iowa (PFI) is a nonprofit, farmer-member organization that works to share information about profitable, environmentally sound farming practices and that encourages both farmers and agricultural scientists to research related questions. PFI has developed a methodology for farmer-managed on-farm trials that has been recognized for its statistical precision and user accessibility. Practical Farmers of Iowa has since its formation in 1985 sought collaboration with Iowa State University researchers and ISU Extension. Two Extension associates now coordinate PFI on-farm trials and education programs.

A number of PFI members use ridge tillage, a system in which crops are grown on permanent ridges. This is a minimum-tillage system in which the soil is not disturbed from harvest to planting. Row crops are customarily cultivated for weed control and to reform the ridges. Ridge tillage has not been as extensively researched as have no-till and conventional forms of crop production, but enough documentation exists to suggest the potential benefits and problems of ridge tillage.

Most lacking has been information on the application of ridge tillage to achieve environmental and efficiency goals. Through this project, PFI farmers are both demonstrating and researching ridge tillage in the context of working production systems. They are using randomized, replicated field trials to document the effectiveness and economics of alternatives in fertilizer rates and placement, weed management, and cover crops. They are also comparing ridge-till to other popular tillage systems, and they are utilizing the basic ridge tillage technology to move into more complex and diversified systems like narrow strip intercropping. Results from the first two cropping years show ridge tillage to be compatible with practices that benefit the environment (e.g., nitrogen rate reductions, banding of fertilizers and herbicides, nonchemical weed management, cover cropping, narrow strip intercropping). The economics of ridge tillage also compared well to that of other systems in the first year of the project.

These research/demonstration plots often involve collaboration with university researchers and county Extension personnel. Agricultural scientists find in these trials an opportunity to conduct research at a greater number of sites, sites that closely approximate the "real world," and sites where skilled management contributes to the success of new practices. PFI farmers gain the expertise and laboratory facilities of the researchers. But in practice the collaboration is greater than the sum of these parts, as researchers and farmers together focus on new hypotheses.

Likewise, the involvement of county Extension personnel adds to the "multiplier effect" of these demonstrations, yet an equally important long-term effect may be the reinforcement of a local consensus for stewardship and sustainable agriculture.

Objectives
Demonstrate that a ridge tillage row crop production system is economically competitive with other systems and helps achieve the goals of sustainable agriculture by reducing total tillage, soil erosion, herbicide use, nitrate leaching, and energy consumption.

Increase the information base on the management of ridge tillage for sustainable agriculture by encouraging a science-based, self-help approach to problem solving through replicated research trials conducted on farms by producers with the assistance of Iowa State University scientists.

Results
There are a number of practices compatible with or made possible by ridge tillage that have immediate economic benefits. For example, in 1993 Practical Farmers of Iowa cooperators saved on average $5 per acre by testing for soil nitrate and side dressing N at cultivation. There are other options made possible in ridge tillage that benefit the environment and yet cost the farmer no more in out-of-pocket expense than conventional practices. For instance, reduced-herbicide weed control was more profitable than high-chemical weed management in 1993. Narrow strip intercropping is a system that is made feasible by ridge tillage and one that delivers benefits both to conservation and short-term profitability.

Less quantifiable but equally important are the effects these farmer-managed demonstrations have in the communities where they take place. The message to farmers is that there need not be a trade-off between the environment and profitability, and that ridge tillage is one means of achieving those ends. The demonstrations also show that farmers can be active partners in the scientific process, collaborating with university scientists and local Extension personnel to create a whole greater than the sum of its parts.

New hypotheses have been generated when farmers and researchers work together on an equal footing. For example, Dr. Antonio Mallarino has carried out experiments in phosphorus and potassium rates on PFI cooperators' fields for several years. The experience has called his attention to the effect of fertilizer placement in minimum tillage situations, so subsequent research will focus on this variable. Nitrogen rate trials in which PFI cooperators undercut even the low rates recommended by the late spring soil nitrate test have contributed to the formulation of new guidelines for the test. Collaboration on narrow strip intercropping has brought to light the need for a profit from the "third crop," so researchers and farmers are now examining uses for an annual legume, berseem clover, that has not previously been grown in the Midwest. Other new hypotheses and approaches will likely emerge with continued farmer-scientist collaboration.

Outreach
In 1993, total attendance at PFI farm field days was 1,163. These events took place before collection of crop yield data, but they provided an opportunity to acquaint the public with the overall project and its goals. Rainy weather plagued many of these field days, as it did crop production in 1993.

On-farm trial results were summarized for the annual winter meeting of Practical Farmers of Iowa, January 6,.1994. There 23 farmer cooperators reported on their experiments to the PFI membership and the general public. A copy of the meeting program containing results is attached. The meeting was attended by 150 and covered by a widely heard Iowa radio station (WHO) as well as the *Des Moines Register*.

Project results were also reported in the *Practical Farmer*, the PFI newsletter, which is sent to over 800 members, Extension and Soil Conservation Service offices. This newsletter was also available to the public at winter PFI meetings, tillage shows, the *Wallaces' Farmer Hay Expo*, and PFI field days in 1994. Additionally, project results were used by cooperators when they spoke to meetings of other organizations and in other states.

Compost Extracts and the Biological Control of Foliar Plant Disease

Project Number:
ANC 95-32

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Funding:
ACE: $40,000
Match: $63,091

Duration:
September 1995 - August 1997

Keywords:
Biological Controls

Abstract
If successful, the research will provide for conventional growers a needed alternative to chemical fungicides and, for organic farmers, a nonchemical means to control disease. Moreover, the utility of compost extracts is by no means restricted to apple scab and, in theory, they could be used to control many foliar diseases. By publicizing the concept of recycling wastes, the project will advance the sustainable philosophy among city dwellers with home gardens as well as among commercial growers. The work is consistent with ACE goals and will promote Environmentally Sound Management Practices, including: 1) provision of scientifically based approaches to non-chemical, non-polluting, biodynamic practices, specifically with respect to approaches to and explanation for composts as they affect plant pathogens; and 2) promote methods for animal waste and nutrient management that reflect recognition of agricultural profitability together with ecological and environmental values.

Objectives
To expand field testing of water extracts of spent mushroom substrate (SMS) composts for seasonal and over wintering control of the apple scab disease. We will supplement SMS with isolates of antagonistic microorganisms.

To continue determination of the pathogen- and disease-inhibitory principle(s) in the SMS extracts.

To determine whether extracts can be stored frozen or lyophilized.

Approach
The working hypothesis is that the compost extracts can be used in practice to control apple scab and certain other foliar diseases.

For Objective 1: Biocontrol efficacy under field conditions. We will further test our best preparation, SMS, by spraying branches of large trees in a commercial orchard and at a research station at 7-14 day intervals throughout the growing season. Disease severity on the foliage will be rated three times (June, July, August) on samples of 50 spur and 50 terminal leaves per tree per treatment (12 trees per treatment) by three standard methods (Horsfall-Barratt scale [12]; presence/absence; and as Friedman ranks; and compared with disease on positive (fungicide-sprayed) and negative (water-sprayed) controls. Because the extracts may well have an effect on insect pests and nutrient status, trees will also be assessed for insect damage and overall vigor. We will expand the number of trees used in the commercial orchard from 6 to 12 thereby increasing our power to detect significant treatment differences.

Further, we will determine whether SMS alone or as amended can control white mold of soybean (*Sclerotinia sclerotiorum*), an endemic and increasingly serious disease problem in the Midwest. The hypothesis to be tested is that application of compost extracts to the aerial portion of plants during the blossoming period will provide significant disease reduction. Control treatments will be water and the fungicides Benate and Topsin M applied at label rates. A randomized complete block design with four replications of each of the four spray treatments and three soybean cultivars will be used. Each plot will measure 2.5 x 8 m from which the center 1.5 and 7 m will be harvested. Plants will be sprayed with SMS extracts at the onset of flowering (approximately 6 July), at full bloom (approximately two weeks later), and at petal fall (about 6 August). Data to be collected include disease index yield, and population levels of fungi and bacteria in blossoms as assessed by standard plate counts.

To determine the potential of compost extracts to control the over wintering stage of the pathogen, naturally infected apple leaves will be collected in the fall, arranged in mesh bags, and sprayed with representative extracts. In brief this involves: 1) assigning 100 weighed leaves at random to a 30 x 30 cm nylon mesh bag (15 um holes); 2) spraying one or both surfaces of the enclosed leaves with compost extracts; 3) staking bags on the orchard floor in a randomized complete block design and leaving them in position until the green tip stage of apple tree development the next spring; 4) recovering all samples and determining ascospore production, leaf strength, and dry weight loss. Each compost extract treatment will be applied to six bags, each of 100 whole leaves. The controls will be water-sprayed leaves and leaves treated with soil extract. The dry weight of each group of leaves will be determined by multiplying the fresh weight and a conversion factor obtained by drying three sub samples of 10 g of leaf material to constant weight. The first over wintering trial is in progress.

For Objective 2: Mechanism of action. Extracts have been subjected to molecular weight fractionation by filtration and found that the principle(s) passes through membranes with molecular weight cut-off limit (MWCO) of 3000 Diluteness. This indicates that the compound(s) is a small molecule such as an antibiotic (peptide, lipopeptide, aminoglycoside, or aminopolyol. To characterize the active principle(s), we will further purify the 3000 MWCO filtrate by TLC, HPLC, cation-exchange chromatography, and high-voltage paper electrophoresis as appropriate (7,24). Purified fractions that inhibit fungal growth and disease will be further characterized at the UW Biotechnology Center by mass spectroscopy and nuclear magnetic resonance analysis. In view of our preliminary evidence.

For Objective 3: Storage of extract. We will test whether SMS extract can be stored frozen or freeze-dried. Extracts will be frozen or lyophilized for various periods (one week, one month, six months), reconstituted as necessary, and compared against fresh extracts for fungal inhibition in the standard germination assay and for disease suppression on seedlings and in the field.

Outreach

The work will be evaluated and conveyed to the public by: 1) ongoing meetings among the collaborators; 2) presentations to farmers at workshops and grower meetings; 3) oral and written presentations in the scientific media; and 4) annual reports to the sponsors. Additionally, outreach will be facilitated by: 5) contacts between the researchers and the Wisconsin Rural Development Council and 6) contacts obtained through the Michael Fields Agricultural Institute and the orchardist and our other collaborators.

Late Blight Education and Management Plan

Project Number:
ANC 95-31

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Funding:
ACE: $25,000
Match: $37,920

Duration:
July 1995 - April 1996

Keywords:
Education/Networking/Extension

Abstract
Control of plant diseases in the production of fruits and vegetables probably presents the greatest of all pest challenges for producers. Completely shifting to a non-chemical program is not likely in most cases. Reduced use, however, can be accomplished by using a comprehensive research and extension program incorporating a high level of extension/research/producer interaction.

Because of severe *Phytophtora infestans* (late blight) disease pressure on potatoes in the eastern United States over the past several years, spray programs have become more intense. Growers have experienced high yield losses and, at the same time, incurred high control costs.

This program involves potato producers, Michigan State University (MSU), the Michigan Potato Industry Commission (MPIC), and others forming a "Late Blight Guidance Committee" with the objective of hiring a "field" and "research" ready specialist to orchestrate a blight control program for Michigan potato growers.

The program's primary goal is the reduction of fungicide sprays used to control late blight. The 1995 Pesticide Use Survey will indicate its success. A shift to more effective products will also be documented by the 1995 pesticide survey. This plan will incorporate a number of management techniques to assist growers in managing the disease.

The primary goal of this project is to minimize pesticide use. We can assume a positive contribution will have been made to the environment and the health of the public, if this goal can be accomplished. By implementation of this project, a significant contribution will be made to turn the tide toward reduced use of fungicides rather than increased use.

Objectives
The following objectives will be addressed:
Reduced use of fungicide application.
Increased use of scouting to identify the disease.
Eradication of infested area.
Identification of strains susceptible to metalaxyl or resistant to metalaxyl.
Use of alternative products to control the resistant or non resistant population.
Education of growers about management techniques.
Education of growers about the spread of late blight.
Spread of late blight disease by seed.

Approach

The program outlined in this grant request will be carried out by Dr. Willie Kirk. Dr. Kirk has accepted a one year (May 1, 1995, through April 30, 1996) appointment at Michigan State University. The specialist will provide leadership in the following ways:

Using a 50 percent extension position, Dr. Kirk will spend time in the field or in personal contact with growers, chemical representatives, extension personnel, and others.

Using the 50 percent research appointment, Dr. Kirk will be able to evaluate technical information from other researchers, and use their information to assist in extension recommendations. Additionally, he will conduct fungicide field trials in Michigan to find the most effective late blight control product. The Biopesticides and Pollution Prevention Division's (BPPD) goals are to reduce the human health and environmental risk from pesticides. Clearly, the control of crop disease and judicious use of pesticides present difficult challenges for BPPD and farmers. Late blight is an incredibly complex disease to control. Because of the incident of the disease in 1994 and previous years in the eastern U.S., growers are at a "teachable moment." The Michigan potato industry has committed to underwrite late blight funding.

Reduced Tillage and Fungicide Input for Enhanced Sustainability in Fresh Market Tomato Production

Project Number:
ANC 95-30

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Funding:
ACE: $30,853
Match: $22,302

Duration:
July 1995 - September 1996

Keywords:
Crop Production

Abstract
Fungicides are applied on nearly 100 percent of fresh market tomato hectarage in the North Central production region. Up to 12 or more applications are required each season. While pesticide-reduction strategies have been investigated for processing tomatoes, similar information is not available for fresh market tomatoes. Therefore, the integration of a reduced fungicide program and conservation till age will be studied in fresh-market tomatoes for control of early blight (EB)(*Alternaria solani*), anthracnose (ANTH) (*Colletotrichum coccodes*), and soil rot (SR)*(Rhizoctonia solani*). Fungicides will be applied according to the disease forecast program TOM-CAST. Integrated disease management of EB, ANTH, and SR may be possible with reduced fungicide input and the use of cultural practices affording advantages associated with sustained productivity of farmland.

Objectives
Evaluate the potential of integrated disease management practices including:

Disease forecasting model.

Reduced till age for the control of early blight, anthracnose, and soil rot in a fresh market tomato system that includes rotation to cucumber, use of rye cover crops, and a mustard green manure.

Methods
Field experiments will be conducted on a Spinks sandy loam (87.4 percent sand, 6.0 percent silt, and 6.6 percent clay) at the Southwest Michigan Research and Extension Center near Niles, Michigan. A split plot design will be used with four replications arranged in randomized complete blocks. Main plots will be divided into two 12 x 42 m subplots to investigate the influence of tillage (conventional vs. zone tillage). Each subplot will be divided into seven 12 x 6 m sub-subplots to investigate fungicide treatments (for a 2x2x7 factorial design [n=112]). Plots planted to tomato will consist of fours rows of fresh market "Pik Rite" tomatoes. Cucumber "Flurry" will be used in rotation.

Tomato seedlings will be grown in a commercial greenhouse in 288-cell flats for four to five weeks. Seedlings will be transplanted in late May or early June using a conventional single-row transplanter with double disk openers and a wide rubber drive. Seedlings will be spaced 0.3 m, on 1.5-m centers.

Overhead sprinkler irrigation will be applied as needed.

In the fall prior to the initiation of the study, the field plot will be plowed and drilled to mustard. Mustard was chosen for its potential to reduce inoculum of plant pathogens (Mojtahedi et al., 1993; Muehlchen et al., 1990), grow rapidly and protect the light sandy soils from erosion, and retain nutrients that otherwise might leach from the soil.

Main plots: Conventional tillage (CT) is one treatment and consists of spring mold board plowing to a depth of 20-23 cm when the over wintered rye is 15-20 cm tall. Up to two additional field passes with a disk, drag, or both will be employed for field preparation before planting. After each tomato harvest, plots will be conventionally tilled and rye seeded. Zone tillage (ZT) will be used as a second tillage treatment. In early spring (late March to early April) of each year, paraquatt (Gramoxone) (1.1 kg ha^{-1}) will be applied to the over wintered rye in strips 0.46 m wide on 1.5-m (row) centers to minimize rye biomass where tomato or cucumber plants are to be established. The inter-row rye will be desiccated with parakeet when it reaches a height of 1 to 1.2 meters.

In ZT plots each spring, the Tye paratill (Tye Company, Lockney, Texas) will set to fracture the soil to ~ 35 cm deep with minor surface disturbance and no soil inversion. Zone tillage will be performed on the exact same row center where tomato plants once stood and tomato or cucumber are to be planted. All plots will be conventionally tilled after harvest in the second year as described above.

Subplots: Fungicide treatments include unsprayed, sprayed weekly, or sprayed at intervals according to a disease forecasting model, TOM-CAST, that calculates a daily disease severity value (DSV) based on the average temperature during hours when leaves are wet (Pitblado, 1992). TOM-CAST is similar to the FAST model developed by Madden et al. (1978). Hourly mean temperature and leaf wetness will be recorded using the Omnidata model DP223 temperature and leaf wetness recorder (Omnidata International, Inc., Logan, Utah). TOM-CAST calls for an initial spray on 11 July or earlier if DSVs reach a threshold of 35 for seedlings planted prior to 23 May and 45 for seedlings planted after 23 May (Pitblado, 1992). Subsequent sprays will be applied after the accumulation of every 13, or 18 DSVs. The fungicides Bravo 720 (chlorothalonil) or Penncozeb (ethylene-bisdithiocarbamate) will be used throughout the study at the full recommended rate.

Results

The study described by this grant has been conducted for two growing seasons with two additional growing seasons planned. Thus far, unpublished data suggest that fungicide sprays can be reduced substantially (a minim of 50%) and still provide control comparable to that observed with calendarized conventional sprays. In 1994, fungicides were applied weekly (15 sprays) or at Tom-Cast DSVs of 13 (7 sprays) or 18 (5 sprays).

It appears that the use of strip tillage in association with rotation reduces the incidence of disease in comparison to conventional tillage. In the unsprayed strip tillage plots, an average of 62 percent of the fruit showed symptoms of EB, SR, and/or ANTHR. When Penncozeb was applied according to the following treatments: 1) 7-day intervals, 2) DSV=13, and 3) DSV=18, average fruit rot incidence was 21, 23, and 40 percent, respectively. When Bravo 720 was applied at 7-day intervals or according to DSVs of 13 and 18, incidence of fruit rot was 8, 12, and 33 percent, respectively.

In the conventional tillage plots, and average of 72 percent of the fruit harvested from the unsprayed control were infected with fungal fruit molds. When Penncozeb was applied according to the following treatments: I) 7-day intervals, 2) DSV=13, and 3) DSV=18, average fruit rot was 25, 34, and 29 percent, respectively. When Bravo 720 was applied at 7 day intervals or according to DSVs of 13 and 18, average fruit rot incidence was 17, 23, and 38 percent, respectively.

Utilization of Oilseed Rape as a Biocontrol Agent for Nematodes Parasitizing Corn in Illinois

Project Number:
ANC 95-29

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Funding:
ACE: $28,909
Match: $28,357

Duration:
September 1995 - August 1997

Keywords:
Biological Controls

Abstract
Management of plant parasitic nematodes of corn currently requires either a long rotation period with non hosts or the use of systemic nematicide/insecticides. Neither option is entirely satisfactory and additional strategies are needed. The use of nematicide, although generally effective, pose numerous problems for producers including potential hazards from loading and handling these extremely toxic compounds, off-site effects such as groundwater and soil pollution, and high costs. An alternative strategy is the use of naturally occurring compounds found in crucifiers such as oil seed rape. Members of the *Cruciferae* family produce compounds known as glucosinolates, which, when combined with a cellular enzyme, produce cyanide containing compounds. The compounds are formed and released upon cellular injury such as dusking and incorporation of the plant materials in fields. Previous studies have shown that crucifiers can be used to reduce populations of many plant-parasitic nematodes. The objectives of this research are to evaluate the use of oil seed rape (*Brusque napus*) in a corn and soybean rotation as a means of reducing economically-damaging nematode populations and to develop an acceptable method of incorporating oil seed rape in a normal rotation. A field site in northern Illinois known to have moderate to high populations of common com nematodes has been identified and a cooperator selected to assist in this project. Plots will be established using various rotation systems of corn and soybeans with either spring-planted or fall-planted oil seed rape as an additional crop.

If oil seed rape can be used to manage nematodes, corn producers will benefit from a reduction in potential contamination of water and soil, as well as improving the health aspects of workers and others who may be involved in pesticide application.

Objectives
To evaluate the impact of oilseed rape as a replacement for chemical nematicide in corn production.

To develop an acceptable method of incorporating oilseed rape in a normal rotation system.

Method
The first objective, to evaluate the use of an oil seed rape (*Brusque napus*) to reduce nematode populations, will evaluate naturally-occurring toxic compounds to replace chemical nematicide. Plants in the family *Cruciferae* contain a group of sulfur-containing compounds found in plant cells known as glucosinolates which are thought to be a part of normal plant defenses against pests.

When cellular injury occurs, glucosinolates react with an enzyme, moroseness (thioglucoside glucohydrolase), to produce a series of compounds including thousands of isothiocyanates which are toxic to nematodes, according to previous work. These naturally toxic compounds are of minimal hazard to humans or the environment and do not have the risks associated with handling highly toxic pesticides. They are not "activated" until crucifiers are injured or decomposition occurs. This would be accomplished through a dusking operation to incorporate the oil seed rape as a green manure crop. Although cyanide-containing compounds are released with decomposition, the amounts are not hazardous to humans, especially when compared to much higher application levels of chemical nematicide. The only disadvantage to crucifiers is that ingestion of crucifiers by non-ruminant animals can adversely affect growth and reproduction. However, there is a negligible risk for this occurrence when compared to the potential hazards of toxic pesticides.

The rapeseed cultivar 'Humus' was selected because of previous work indicating of dagger nematode in orchards. An irrigated field site has been selected in northern Illinois which was previously identified as having economically-damaging levels of dagger, lance (*Hoplolaimus spp.*), and other genera as well as low to moderate populations of needle nematode. Propellant soil sampling in April of 1995 confirmed high populations of dagger and moderate to high populations of lance nematodes as well as low populations of needle nematodes. The cooperator does not plant corn in this field without a nematicide and is seeking an alternative management method. However, at the present time, he cannot economically produce corn without crop rotation to soybeans plus a nematicide. Oil seed rape as either a spring or fall-planted crop may offer a satisfactory and economical method of nematode management to replace chemical nematicide.

Evaluations will be made of nematode control from fall and spring plantings of oil seed rape to determine the most appropriate means of introducing oil seed rape into a normal corn and soybean rotation system. For such a system to be successful, it must be adaptable to current planting programs. If there is a high cost associated with adding oil seed rape (i.e., loss of one season of production with spring plantings of rape) which cannot be economically offset with added benefits, it will be difficult to convince farmers to use such an approach. However, the benefits in terms of reduction in potential groundwater problems, soil savings from use of oil seed rape as a cover crop in winter, and other non-production benefits may offset any losses. This objective may be the most important in terms of pesticide reduction and benefits to the farmer and environment.

Reducing Herbicide Use with Machine Vision Technology

Project Number:
ANC 95-28

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Funding:
ACE: $24,909
Match: $24,708

Duration:
September 1995 - August 1997

Keywords:
Weed Control

Abstract
Ballasted sections supporting railroad tracks and the road shoulders of this nation's rural highways are two areas commonly kept in vegetation for a variety of reasons. There are approximately 140,000 miles of railroads and 3.3 million miles of rural highways in the US (Morgan, 1993; USDA, 1979). Assuming a minimum width of 16 ft for railroads and 4 ft wide shoulders on each side of a road, several million acres are maintained weed-free. Total vegetation control is usually accomplished with combinations of post emergence and pre-emergence herbicides. Post emergence herbicides control the weeds present but have little environmental persistence. Pre-emergence herbicides, because of their inherent residual soil activity, have environmental concerns, e.g., ground and surface water contamination, and uptake by roots of nontarget plants located off-site. Reducing the use of pre-emergence herbicides could be possible if post-emergence herbicides could be applied in a more cost effective manner.

Where railroads and highways are treated by commercial applicators, it is not uncommon for the payment to reflect gallons applied, not degree of weed control. This does not promote reduced herbicide use. Machine vision technology enables a spray unit to treat weeds automatically after they are detected. The adoption of machine vision technology will entail changes in the approach to contract herbicide applications to highways and railroads.

This proposed research will examine the operational potential of machine vision spray technology, e.g., the Weed Seeker Sprayer, for-railroads and roadsides. This will include determining the effect of weed size and travel speed on sprayer detection. We will compare: 1) a standard residual soil active herbicide combination; 2) a nonresidual, translocated herbicide treatment; and 3) a contact herbicide treatment, the biopesticide, pelargonic acid. Weed control will be determined by stem counts in subplots. Amounts of carrier and herbicides will be recorded for each treatment. The Weed Seeker Sprayer has been reported to reduce herbicide use by 75 percent in orchards.

Objectives
Determine the effect of weed size and equipment speed on the machine vision sprayer sensitivity and accuracy on rights-of-way.

Compare a residual treatment combination with repeated nonresidual translocated treatments.

Compare a nonresidual translocated herbicide with the biopesticide pelargonic acid.

Transfer technology to the decision makers in the railroad and roadside industries.

Approach and Methods
Weed detection efficiency will be determined by running the sprayer over the same area at increasing speeds, i.e., 4, 8, and 12 mph, with colored water in the system. The amount used will be recorded. Subplots will be used to determine numbers and sizes of plants treated. The field procedures for comparing herbicide treatments applied conventionally and with the Weed Seeker Sprayer will be very similar. A randomized complete block experimental design with four replicates will be used. Plots will be 0.25 mile in length. Amounts of carrier and active ingredient will be recorded for all tests. The residual treatment combination will include diuron, sulfometuron methyl, or a dinitroaniline herbicide, depending on what the railroad or highway department is using. The nonresidual, translocated herbicide treatment will be glyphosate + 2,4-D amine. Weed counts will be made on subplots established systematically over the treated plots. Tests will be established on both railroads and roadsides.

Outreach
Technology transfer for the railroad industry will occur through presentations at the National Railroad Contractors Association (NRCA) Weed Control Seminar held each January in Indianapolis, Indiana. The initial data for the Weed Seeker Sprayer will be presented at the Committee 1, Roadway and Ballast, American Railway Engineering Association (AREA), meeting in Houston, Texas, in February, 1996. Field days for railroad and roadside managers will be conducted each summer. The results will be published in the trade journal *Railway Track and Structures* and the AREA Bulletin. The roadside industry will be reached through presentations at the National Roadside Vegetation Management Association (NRVMA). Written material will be published in the NRVMA Proceedings and the trade journal *Roads and Bridges*.

Evaluation
Quantifiable environmental results will be in the form of number of weeds and amounts of herbicides and amounts of carrier used. The array of treatments will enable comparisons of conventional treatments with repeated treatments. Comparative treatment costs and weed control results will be easily determined. The Weed Seeker Sprayer should result in reduced herbicide use which reduces environmental load, applicator exposure, and drift potential.

On-Farm Evaluation of *Beauveria bassiana* for Long-Term Suppression of European Corn Borer in Midwestern Cropping Systems

Project Number:
ANC 95-27

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Funding:
ACE: $30,167
Match: $18,416

Duration:
September 1995 - August 1996

Keywords:
Biological Controls

Abstract

The European corn borer (ECB), *Ostrinia nubilalis* is a serious pest of corn in the Corn Belt, causing estimated yield losses in the Midwest from $50 to $120 per hector of corn (est. $20-$50/acre). With increasing restrictions on insecticides, the call for sustainable agriculture and the federal mandate for less surface and ground water remediation, there is a greater need for innovative methods to control this pest.

We propose to use on-farm demonstrations, with cooperators from the Practical Farmers of Iowa (PFI), in a bio-intensive approach to managing this insect. An entomogenous fungus *Beauveria bassiana*, that develops a unique endophytic relationship between the corn plant and the European corn borer will be employed in this management system. The fungus will be applied to corn at the whorl stage, pollen-shedding stage and at senescence (harvest) to manage the freest generation, second generation. and over-wintering European corn borer larvae. In small field plots *B. bassiana* has been shown to reduce plant feeding during the growing season and any *B. bassiana* present at harvest kills over wintering larvae, reducing the following year's population. Once this fungus is placed in the ecosystem it will maintain itself in the soil crop residue, and the growing corn plant. It will colonize plants in subsequent years, eliminating the need for continuous application of the fungus. If this sequence is practiced over a wide area it may be possible to maintain the corn borer below an economic threshold without use of synthetic chemical insecticides. This approach may completely transform European corn borer management. Primary benefits of this proposed research are: 1) reduced producer dependency and exposure to synthetic insecticides; 2) less environmental contamination; and 3) a contribution to long-range goals of reduced environmental and ecological disruption from overuse of insecticides.

Objectives

Develop methods to use *Beauveria bassiana* for on-farm within season suppression of floweriest and second generation European corn borer larvae.

Document that the use of *B. bassiana* in Objective I combined with a harvest application of *B. bassiana* for over-wintering European corn borer larvae will provide multi-season suppression.

Approach
Investigations will be conducted at four locations i.e., an Iowa State University Agricultural Experimental Experiment Station site and three farm sites operated by members of the Practical Farmers of Iowa (PFI). Practical Farmers of Iowa has worked with university researchers to develop protocols for on-farm research that yield statistically valid information and that also are straight forward for farmer use. Experimental units are long field strips that are the width of one or two passes of the available farm machinery. Thus the field can be farmed for profit while the trial takes place. Simple, randomized complete block designs are used. The ISU Extension Practical Farmers of Iowa farming systems coordinator assists cooperators with planning, analysis, and interpretation of trial results. The statistical precision generally achieved by PFI on-farm trials compares well with that of typical experiment station trials, although their design is generally simpler and their goals less ambitious than those of on-station trials.

PFI cooperators have completed 386 replicated field trials since 1987. During this time attendance has been more than 10,000.

Evaluation
Once the objectives of the research have been met cooperating farmers will know how to show the farmer to manage the European corn borer without the use of synthetic chemical insecticides. They will communicate this information to other Iowa farmers at the project field days. Reduction in damage by the European corn borers and mycosis in the overwintering larvae will be evidence of the success of the program, which translates to reduced risk to the health of farmers and consumers and an improvement of environmental quality.

An Integrated Riparian Management System to Control Non-Point Source Pollution and Enhance Wildlife Habitat

Project Number:
ANC 95-24

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The Iowa Department
of Natural Resources

Iowa State Agroforestry
Research Team

Funding:
ACE: $102,600
Match: $182,212

Duration:
September 1995 - August 1997

Keywords:
Soil/Water
Waste Management

Abstract
This project proposes the expansion of an integrated riparian management system that can be used to rehabilitate riparian zones devoid of native tree and shrub vegetation, to control the adverse effects of upland agriculture on stream water quality, and to improve wildlife habitat. The proposed project represents a continuation and expansion of present initiatives currently supported by ACE and takes advantage of unique opportunities at the research site. The existing constructed, multi-species riparian buffer strip (CMRBS) was expanded in 1994 to include another one mile of stream length immediately upstream. The landowner/cooperator at this site employs fundamentally different agricultural management practices. This will allow for the investigation of CMRBS function under radically different conditions. This opportunity will also allow the replication of constructed wetlands to process agrichemicals contained in tile drainage and of the soil bioengineering technologies to stabilize eroding stream banks.

The ability of this integrated riparian system to improve water quality will be quantified through the monitoring of sediment, nitrogen, and outreason in the surface runoff, shallow and deep groundwater, stream and tile water, and plants and soil in both the CMRBS and the wetland. The rate of stream bank collapse of the willow-planted stream banks will be compared to that of similar, untreated stream banks. The enhancement of fish and wildlife habitat will be assessed with a number of surveys throughout the project life and by comparison with degraded riparian areas. Costs and benefits will be developed that will allow farmers to evaluate the design, establishment. maintenance, and effectiveness of each individual practice and the integrated system. Technology transfer will consist of a video and slide set, annual field days, and a self-guided trail.

The project will quantify the ability of an integrated riparian management system to reduce non-point source pollution to surface waters and to enhance wildlife habitat. It will provide to the farmer the design, establishment procedures, and maintenance requirements for the components of the integrated system as well as the costs and benefits. Also, it provides a single site on which all three practices of the integrated riparian management system can be demonstrated by various technology transfer activities.

Objectives
Quantify and compare the ability of constructed, multi-species riparian buffer strips located on farms employing different management practices to filter, transform, and act as a sink for non-point source pollution.

Construct two wetlands to intercept and process agricultural tile drainage waters before they enter the stream.

Demonstrate the ability of soil bioengineering techniques to act as a durable and environmentally acceptable system for long-term stabilization of eroding stream banks.

Evaluate the impact of the expanded riparian management system on wildlife habitat and use.

Evaluate the costs of establishing and maintaining the three riparian management systems being demonstrated.

Develop technology transfer materials and activities for farmers, policy-makers, farm groups, and others.

Outreach
ISTART has been active in developing a focused educational demonstration program to present the benefits and shortcomings of the CMRBS, the constructed wetlands and the soil bioengineering technologies to farmers and other groups. Over 500 individuals toured the CMRBS site in 1994, printed material was sent out to many people who requested it and the information has been included in numerous presentations by ISTART team members. Farmer evaluations and testimonials have been overwhelmingly positive. The adoption of the riparian zone management system has gained momentum. Project members have been active in providing assistance to individuals or organizations interested in restoring riparian zones and in discussions with professionals from Minnesota, North and South Dakota, Nebraska, Missouri and Kansas.

Assessing the Potential for Biological Control of Field Bindweed (*Convolvulus arvensis*) with the Gall Mite (*Aceria malherbe*) and the Moth, *Tyta luctuosa*

Project Number:
ANC 93-18

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Funding:
ACE: $75,185
Match: $32,848

Duration:
July 1993 - August 1996

Keywords:
Biological Control
Weed Control

Objectives

Insect biology.

To evaluate the overwintering potential of the gall mite - *A. malherbe*, and the moth *T. luctuosa*, in different climatic zones within the North Central Region.

To determine the dispersal ability of the moth (*T. luctuosa*) at several release sites.

Plant-insect interactions.

To determine the effects of moth (caterpillar) introductions on field bindweed growth, and determine the infestation levels necessary to ensure detrimental effects to field bindweed.

To investigate and quantify field bindweed population reduction by the moth (caterpillar).

Grower training and dissemination of knowledge.

To train and involve farmers with on-farm releases, surveying, and monitoring of the biological control agent, and in the evaluation of success.

To disseminate knowledge of the symptomology, ecology, and biology of moth to farmers and farmer organizations, extension personnel, other researchers, and those concerned with noxious weed control.

Results

The bindweed moth, *Tyta luctuosa*, overwintered successfully for the second straight year in Kansas. However, survival in 1994-95 varied greatly among and within locations in Kansas. The average rate of survival, from the cocoon stage in the soil to fully emerged adult moths capable of flight, ranged from 0 to 23 percent. The highest survival in a single cage was 64 percent. Moth survival was no higher at southern sites than at northern ones. We also identified the approximate chemical makeup of a sex attractant which we plan to synthesize and use as a monitoring tool for assessing dispersal and establishment of bindweed moths. A field experiment revealed that moderately high densities (about 75/m^2) of large *T. luctuosa* caterpillars are necessary for complete defoliation of bindweed in the field. Through presentations, tours, radio shows, press releases, and individual on-farm training sessions, we have continued to educate farmers, county weed personnel, and the general public about our biological control research efforts for field bindweed.

These activities have increased awareness of non-chemical alternatives for managing weeds, and the potential of using natural enemies to control field bindweed, an extremely serious pest in the Midwest and throughout the United States. Dissemination of our project goals and research findings also has led to cooperation from local farmers.

Outreach

Presentations

February 10, 1995. *Annual Winter Meeting of the Kansas Association of County Weed Supervisors.* Approximately 100 people attended representing the 105 counties in Kansas. At this meeting, we presented a slide program to update noxious weed directors on our biological control of field bindweed research, including results of our first-year overwintering survival and feeding preference experiments. We received several questions from directors who were interested in cooperating on the project.

July 18, 1995. *Annual Summer Meeting of the Kansas Association of County Weed Supervisors.* We provided a walking tour of our greenhouses and insect rearing facilities for approximately 80 county weed directors. We provided demonstration materials, including life stages of bindweed natural enemies under the microscope and explained the field and laboratory research we are doing.

Press Releases

"Noxious weed strangles Kansas crops", pg. 9, KSU Ag Report, Fall 1994. A short, popular article describing our bindweed biological-control research. Published semi-annually for the agricultural community of Kansas.

Radio Show

September 6, 1995. A 15-minute radio show was taped for a daily farm program on KSU. The purpose was to disseminate knowledge about the biological control of field bindweed and an update of our research program here at KSU.

An Integrated Riparian Management System to Control Agricultural Pollution and Enhance Wildlife Habitat

Project Number:
ANC 93-17

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The Iowa Department of Natural Resources

The Ronald Risdal Farm

Funding:
ACE: $90,170
Match: $161,559

Duration:
September 1993 - October 1995

Keywords:
Waste Management

Abstract
The overall objective of this research has been to develop a riparian management system (RiMS) to rehabilitate riparian zones in agricultural ecosystems and to transfer this information to landowners, resource agency personnel, and policy-makers. The integrated management system is intended to restore ecosystem functions associated with a healthy and diverse riparian zone. The system model includes the establishment of a multi-species riparian buffer strip (MRBS) of native tree, shrub, and grass vegetation to control the adverse effects of upland agriculture on stream water quality and to improve wildlife habitat. The initial MRBS was established in 1990 on the Ronald Risdal farm along Bear Creek in central Iowa. The ACE project has provided for the continued development of this site and has allowed for some of the initial quantification of the effects of a MRBS on surface and groundwater quality. In addition, the ACE project has provided for the demonstration of two other components of the RiMS model: soil bioengineering technologies to reduce streambank erosion and constructed wetlands to intercept and process non-point source pollution contained in agricultural tile drainage. The result is a unique riparian management system having three separate practices located on Risdal farm. Other objectives of this project have been to evaluate the effects of the riparian management system on wildlife populations and to evaluate the costs of establishing and maintaining the three components of the RiMS. Finally, the ACE project has provided for extensive technology transfer efforts. The research is being conducted by the Iowa State Agroforestry Research Team and the Agroecology Issue Team of the Leopold Center for Sustainable Agriculture.

An integrated riparian management system was developed along a central Iowa stream to demonstrate the benefits of properly functioning riparian zones in the heavily row-cropped Midwestern U.S. The system consists of three components: a multi-species riparian buffer strip, soil bioengineering technologies for streambank stabilization, and a constructed wetland to intercept and process non-point source pollutants in agricultural drainage tile water.

The general multi-species riparian buffer strip layout consists of three zones . Starting at the stream bank edge, the first zone includes a 9 m (30 ft) wide strip of 4-5 rows of trees, the second zone is a 4 m (13 ft) wide strip of 1-2 rows of shrubs, and the third zone is a 7 m (22 ft) wide strip of native warm-season grass.

This design is important because the trees and shrubs provide perennial root systems and long-term nutrient storage close to the stream while the grass provides the high density of stems needed to dissipate the energy of surface runoff from the adjacent cropland.

Water and chemical movement across the buffer strip are being monitored using a combination of piezometers, tensiometers, and tension lysimeters. Initial results show that nutrient and pesticide concentrations in the unsaturated zone are much lower across the buffer strip than within the adjacent cultivated field. After six years, soil water in the unsaturated zone under the buffer strip never exceeded 3 ppm of NO_3^--N, or 1 ppb of atrazine, even though concentrations as high as 30 ppm and 8 ppb, respectively, are measured in the cropfield. However, nitrate concentrations in the shallow groundwater are highly variable between adjacent transects, suggesting that nitrate contained within shallow groundwater may be moving preferentially across the buffer strip. We are expanding our efforts to accurately characterize groundwater and chemical movement across the buffer strip.

Several streambank bioengineering technologies are being demonstrated at the project site. The first is a combination of live willow posts and dead, bundled, hardwood revetments. The other is a combination of live willow posts and geotextiles in combination with Eastern red cedar or rock rip-rap for protection of the streambank toe. These installations have been very effective in stabilizing the banks.

A small wetland was constructed to intercept and process agricultural chemicals contained in tile drainage. Nitrate loss rates per square meter of wetland sediment are comparable to those observed in experimental wetlands and are dependent upon temperature and residence time of the pollutant laden water. It is expected that the nitrate removal capacity of the wetland will increase as the wetland matures and accumulates a layer of dead plant material.

Establishment of the riparian management system has dramatically improved the wildlife habitat on the farm. Results demonstrate that nearly four times as many bird species are using the buffer strip than are using an adjacent, non-buffered stream reach.

Technology transfer efforts have been very successful. In the last two years over 30 formal tours (>1,000 persons) have visited the site. A self-guided trail has been established to provide information to visitors to the site. Thirteen papers have been prepared and 53 invited presentations have been made to local, regional and national groups. An extension bulletin series entitled "Stewards of Our Streams" is also being produced.

Objectives

Demonstrate and quantify the ability of the MRBS to filter, transform, and act as a sink for non-point source pollutants.

Develop a small wetland to intercept and process field tile drainage.

Demonstrate the ability of soil bioengineering technologies to function as a durable and environmentally acceptable system for long-term stabilization of eroding stream banks.

Evaluate the impact of the MRBS, the constructed wetland, and the soil bioengineering technologies on wildlife habitat and use.

Evaluate the costs of establishing and maintaining the three components of the RiMS being demonstrated on the Risdal farm.

Develop appropriate technology transfer materials and activities for farmers, policy-makers, farm groups, and others.

Compost Extracts and the Biological Control of Foliar Plant Disease

Project Number:
ANC 93-16
ANC 93-16.1

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Funding:
ACE: $103,958
Match: $62,738

Duration:
September 1993 - December 1995

Keywords:
Biological Controls

Abstract

Economic losses due to foliar disease induced biotically or abiotically are difficult to estimate, but are on the order of $1 billion annually in the USA for frost injury alone. Moreover, any direct costs must be viewed within a broader context which includes environmental costs and constraints, increasing cost of pesticide research, and the increasingly frequent revocation of registered (or failure to reregister) pesticides by regulatory agencies.

Apples are among the top five of the major food commodities in the USA. This country ranks second internationally in apple production (about 8 billion pounds valued at $1 billion). The apple scab disease is distributed worldwide. In moist, temperate areas it is considered to be the most important pest problem of the crop. Growers in Wisconsin and climatically similar regions routinely apply 11-15 fungicide sprays each season. Apples rank third nationally in percentage of acres treated with fungicide (78 percent) and third in total fungicide expenditures ($23.5 million). These sprays thus represent an appreciable input cost to growers and, additionally, they can have substantial indirect costs in impact on the environment. Fungicides also pose the threat of adverse effects on health. For example, about 90 percent of all fungicides used in agriculture are animal oncogens. Although these chemicals constitute only 10 percent of all pesticides applied to food crops, they account for roughly 75 percent of the oncogenic risk associated with consumption of processed foods and nearly 60 percent overall (versus 27 percent from herbicides and 13 percent from insecticides).

If compost extracts can be used successfully they will provide, for conventional farmers, a needed alternative to fungicides and, for organic farmers, a nonchemical means to control disease.

For all farmers, compost would facilitate the movement away from high input, synthetic chemical practices towards a sustainable philosophy which emphasizes alternative, low cost inputs, alternative cultural practices, and use of recycled on-farm wastes. It is even possible that home owners in urban areas could use compost extracts prepared from food and yard wastes to control disease in their gardens. If so, this would reduce a significant pesticide source to the environment and one often associated with a misuse.

Ongoing assessment of apple scab for the 1994 growing season in research blocks at two sites shows that aqueous compost extracts of two sources of spent mushroom substrate (SMS) compost provide statistically significant inhibition of the pathogen and disease control. Significant inhibition of shoot blight on red pine seedlings in greenhouses, and of the causal organism, was also achieved.

The inhibitory principle in SMS appears to be heat-stable chemical(s) produced by anaerobic microorganisms during the 5-7 day incubation of the compost slurry prior to filtration and application of extract to plants. Research to date suggests that the mode of action involves both a high MW (>100,000 daltons) and low MW (<3,000 daltons) component. Efficacy of SMS extract is lost by storage at 24 degrees C and 4 degrees C but is retained at -20 degrees C.

Outreach

Publications submitted or appearing in 1994:

Yohalem, D. S., R. F. Harris, and J. H. Andrews. 1994. "Aqueous extracts of spent mushroom substrate for foliar disease control." In *Nature and Uses for Spent Mushroom Substrate.* Edited by D. Levanon and P. J. Wuest. In press.

Yohalem, D. S., C. M. Simmer, J. H. Andrews, and E. V. Nordheim. 1994. "A method to distinguish bias from variation in evaluating spore germination." *Phytopathology* 64:1068(Abstract).

Yohalem, D. S., E. V. Nordheim, and J. H. Andrews. "Calibration of fatigue: identification of systematic bias in data collection and a method for the deletion of discordant observations from small samples." *Phytopathology* (submitted).

Presentations:

22 February 1994. Talk on compost extracts at Wisconsin Fruit and Vegetable Conference, Stevens Point, Wisconsin. Attendance: approximately 100 persons.

11-14 March 1994. Talk on disease control by compost extracts at conference on "Nature and Uses for Spent Mushroom Substrate", Philadelphia, Pennsylvania. Attendance: approximately 70 persons.

26 July 1994. Talk and tour of orchard research involving compost extracts at Ela Orchard, Rochester, Wisconsin as part of Michael Fields Agr. Inst. Orchard field day. Attendance: approximately 75 persons.

6-14 August 1994. Talk on methods to minimize error in laboratory assay of spore germination in compost extracts. Presented at Amer. Phytopathol. Soc. Meeting, Albuquerque, New Mexico. Attendance: approximately 40 persons.

Wildlife Values of Sustainable Agricultural Practices in the Northern Great Plains

Project Number:
ANC 93-15

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Funding:
ACE: $57,000
Match: $206,000

Duration:
September 1993 - August 1995

Keywords:
Soil Quality
No-till Farming

Abstract

In this study we will compare bird use and soil quality among three cropping systems (organic--no synthetic chemicals used, no-till--no tillage used between harvest and seeding, and conventional--tillage and synthetic chemicals used annually). Data will be collected for three major cropland types including wheat for small grain, sunflower for row crop, and fallow for unseeded. Biologists from the Northern Prairie Wildlife Research Center (Wildlife Research Center) will determine population density and diversity of breeding, wintering, and migrating birds using the three cropping systems. All study fields will be searched to locate nests and to determine breeding effort and success. Scientists from the Carrington Research Extension Center (Research Extension Center) will characterize soil quality by measuring physical, chemical, and biological properties. The Northern Plains Sustainable Agriculture Society and the Manitoba-North Dakota Zero Tillage Farmer's Association will collaborate in developing study plans, selecting study cooperators, and specifying data priorities. Cooperating landowners will provide study sites and information on chemical and physical inputs, crop yields, type of equipment used, and data for calculating soil erosion losses.

The Wildlife Research Center will assign one biologist, the Research Extension Center will provide one agronomist, and the Society and the Association each will provide one farmer to supervise the study and insure that standard and appropriate methods are used. The Wildlife Research Center and the Research Extension Center will bear primary responsibility for analysis of the results. The proposed research will augment ongoing investigations by the Wildlife Research Center, which gathered baseline data on wildlife use at study sites during 1992. Additional funds will be used to expand the effort by including additional scientific disciplines and cooperators. This will strengthen the study and provide a valuable opportunity for the different interest groups to work together on a problem of mutual interest.

The enhanced study would build on methodology and a data base already developed and will lead to greater understanding and appreciation of the importance of agricultural and wildlife issues.

The data will be examined to determine the effects of residue management, timing and type of tillage, and pesticide and fertilizer use on soil quality and wildlife populations and breeding success. Practices that benefit land use or enhance wildlife populations will be communicated to individuals managing cropland on private and public lands. Recommendations will be broadcast using the Society and Association newsletters, farm journals, and scientific publications.

Also, the Society will host a seminar on farmland-wildlife relationships, and the Association will include presentations at its annual workshop.

Objectives
To estimate and compare species richness and density of breeding, migrating, and wintering birds using sustainable agricultural cropping systems and conventional systems.

To determine if the three farming systems differ in soil characteristics that might be critical to the overall functioning of the agroecosystem, especially as it relates to wildlife populations.

To inform private and governmental farmland operators of management practices that both benefit land use and enhance wildlife populations.

Methods
The surveys and estimates will be made on a field basis as most farms in North Dakota are not contiguous units but include land that is spatially separated. A field is defined as 40 ha of one crop type on a farm. Fields may comprise several sub-fields which, for logistic reasons, will not be smaller than 8 ha or larger than 40 ha. Landowners will be the primary sampling unit and at each we will study one field (secondary sampling unit) of the three crop types. The study will include 27 landowners, each with three fields for a total of 81 fields or about 3,240 has surveyed.

Landowners will be located by querying each county USDA office in southeastern North Dakota, the Northern Plains Sustainable Agriculture Society, and the Manitoba-North Dakota Zero Tillage Farmer's Association. We expect to obtain nearly complete lists of the organic and no-till growers and will seek a representative sample of conventional farmers. We will visit with potential cooperators and select those who have the appropriate mixture of crops, are actually farming in a conventional, organic, or no-till manner, and agree to grant us trespass right. Finally, we will number each qualifying field owned by each landowner and randomly select those we will survey. A new set of study fields will be selected each year.

Organic farming (no synthetic chemicals used) and no-till farming (no tillage between harvest and seeding) will be studied and contrasted with conventional farming (tillage and synthetic chemicals used annually). Each year, data will be collected for three crop types at 81 individual fields on 27 farms (9 organic, 9 no-till, 9 conventional). The study will be conducted in the prairie pothole region of southeastern North Dakota. In this study we will survey wheat--the most common small grain, sunflower--the most common row crop, and summer fallow--a common non-crop system used to store moisture and nutrients in the soil.

Impacts of Tree Windbreaks on Distribution of Insect Pests and their Natural Enemies in Sustainable Agricultural Systems

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Abstract

Vertebrate and invertebrate (insect) natural enemies of insects, and insect pests were sampled periodically during 1993-1994 in crop fields (corn, soybeans, grain sorghum, wheat and cantaloupe) sheltered and unsheltered by tree windbreaks. Field margins of these fields and tree windbreaks were also sampled. Crop fields with and without adjacent woody areas with waterways (riparian areas) were also sampled for bird species. Bird species were sampled by standard census observation procedures. Insects were sampled by sweep nets, pitfall traps, sticky traps and tree beating techniques, depending on the habitat. Few birds were observed in crop fields during the winter. Bird abundance in crop fields adjacent to either woody or herbaceous edges did not differ during any season except spring 1994. During this sampling period a greater number of birds were seen in fields adjacent to windbreaks. Similar to bird abundances, mean species richness in crop fields adjacent to windbreak and herbaceous edges did not differ. Patterns of bird use within the field were evaluated. Higher bird densities were found within 100m of the edge in spring 1993, within 50 m in late summer 1993 and 1994, and within 25 m in spring and summer 1994. No consistent differences were found in patterns of bird use across fields due to edge type. In fields adjacent to windbreaks, American robins, brown-headed cowbirds and brown thrashers had a greater percentage of observations within 50 meters of the windbreak, whereas horned larks had a greater percentage of observations between 100 and 200 meters from the edge. In fields adjacent to herbaceous fence rows, only dickcissel showed an increased density within 50 meters of the edge. Horned larks showed an even distribution throughout the field. Overall, field edges with woody windbreak vegetation had greater species richness and more individuals than did non-woody edges. However, the greater number of birds in the woody edges was not reflected in the number of birds using the fields except during spring. In general, bird densities in fields were greater near field edges than at distances further into the field, but open-area species such as horned larks (*Eremophila alpestris*) were more prevalent away from woody edges. Spiders were most abundant close to windbreaks and grassy field edges.

Spider numbers were also higher in windbreaks containing coniferous trees compared with sites dominated by deciduous trees. In sheltered and unsheltered cantaloupe fields, fewer arthropods were caught on sticky traps in fields sheltered by tree windbreaks, compared with unsheltered fields. Lady beetles (a predatory insect) were more abundant at sheltered sites and cucumber beetles (a pest insect) were more abundant at unsheltered sites. Windbreak and other vegetation characteristics have been recorded at each site and will be analyzed for correlations to vertebrate and invertebrate survey data.

Yield data has been collected from crop fields but are not summarized or statistically analyzed.

Objectives
To determine the impact of tree windbreaks on the distribution and abundance of crop pests and their natural enemies.

To determine the impact on crop yield of pest populations influenced by tree windbreaks

Results
Spiders were most abundant in windbreaks containing coniferous trees such as juniper or scotch pine, compared with windbreaks containing primarily deciduous trees. Spiders are generalist predators on a variety of insect pest species.

Determination of the bird species and numbers using woody and non-woody corridors and their adjacent crop fields establishes baseline data for evaluating how such areas might be managed to enhance natural enemies of crop pests. Pest insects are susceptible to predation in both the crop field and in the field edge. At field edges, natural enemies can attack pest insects that come to the field edge for some life cycle need or that are blown there by the wind. Our preliminary results indicate that woody field-edge vegetation benefits a wide variety of bird species, including insectivores and omnivores that likely have value as natural enemies of crop pests. Further, our results indicate that neo-tropical migrant bird species, many of which are in decline, benefit from the woody vegetation as habitat during migration or for nesting, and the woody vegetation appears generally important to wildlife conservation in this agricultural area.

Impacts of Agricultural Management Systems on Economic, Environmental and Wildlife Values of Altered and Unaltered Wetland Areas

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ACE 92-11

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Abstract
This research project focuses on the interactions between farm management systems and wetlands in the Prairie Pothole Region. Objectives include the collection and analysis of wildlife/habitat, water quantity and quality, and economic data in order to integrate environmental and economic goals. We have initiated the development of a model farm in order to generalize results from the case study farms to more widespread applications. The model farm is standardized for natural resource, land use and management/farm program characteristics. It also reflects the diversity of natural resource characteristics, cropping patterns, and crop yields of the management systems researched (organic, conventional, and transitional no-till). Analysis of the model farm indicates that the fields with no highly erodible lands (HEL) or hydric soils have the highest returns regardless of management system. The fields which were totally HEL or hydric had the lowest net returns. The highest proportion of HEL and hydric soils in a field to maintain a positive return in all three systems was 46 percent. The next step in development of the model is to incorporate wildlife populations and diversity into the model to determine optimum natural resource and farm management scenarios. Nutrient data will also be added in an attempt to cycle nutrients through desirable resources resulting in agricultural productivity rather than environmental degradation.

Method
Within the study area, three farms with distinctly different management systems were selected for this study: transitional no-till (TNT), conventional (CON), and organic (ORG) farming systems. Each farm management system differs greatly in use of crop rotations, tillage practices, and chemical inputs. However, these farms have common features that facilitate detailed agronomic and economic comparisons:

The three systems are located close to each other with cropland located on similar soil types. The TNT and ORG farms are located in southern Lake county while the CON farm, located in northwestern Minnehaha county, is less than 10 miles from the other two farms.

The principal crops on each farm include corn, soybeans, alfalfa and some small grains which is representative of area cropland use.

Each farm has semipermanent, seasonal, and temporary wetlands. The proportion of wetland acres and hydric soil acres are similar in the ORG and CON management systems and somewhat lower in the TNT system.

In addition, two of the three farms involved in this study have been involved in a whole-farm economic and agronomic study from 1986 - 1992 comparing the sustainability of different farming systems. This study builds on the earlier analysis, but is unique in its emphasis on water quantity, water quality, biomass and crop yield measurements at monitored wetland and upland sites, and its use of field tract data to compare profitability of farming systems at whole-farm and field levels.

Results

Waterfowl pair abundance varied for all species and dates combined in both years. Abundance was highest on temporary wetlands on the ORG system in 1993 and on the TNT system in 1994. On seasonal wetlands, pair abundance was highest on the CON and ORG systems in 1993 and 1994. Pair abundance was highest in both years on the CON system for semipermanent wetlands. Species richness was highest on the ORG system in 1993 and highest on the ORG and CON systems in 1994.

Results indicate that farming practices alone do not influence waterfowl pair abundance; other factors must be considered. Wetlands on no-till land may be more attractive to waterfowl because of residual material in agricultural fields which provides valuable nesting cover. On the other hand, if most organic farms are similar to the one on our study area (small fields with many cover types which provide valuable habitat for nesting), many pairs will opt to use this type of area. Abundance was found to be higher on the conventional system in many instances. This probably was due to the presence of wetlands with excellent "hem-marsh" conditions which waterfowl prefer to use for brood rearing.

As in 1993, abundance of aquatic invertebrate in semipermanent wetlands was generally higher on the TNT system in 1994. Oligochaeta, Ostracoda, Amphipoda, Odonata, Cladocera, and total invertebrate abundance was significantly higher on the TNT system. Abundance on individual sampling dates varied, however it was generally higher on the TNT system. No difference was found in species richness between the two systems on semipermanent wetlands.

Differences for individual species between the farming systems were found in both 1993 and 1994 corn field surveys. Horned larks (*Eremophila alpestris*) were found to be more abundant on the TNT system in 1994. Killdeer *(Charadrius vociferus*) were more abundant on the TNT system in 1993 and on the ORG and TNT systems in 1994. Generally, bird abundances were higher on the CON and TNT systems in 1993, however they were higher on the ORG and TNT systems in 1994. Species richness was significantly higher on the TNT system in 1993. Richness was also higher on the TNT system in 1994, but the difference was not significant.

Stubble corn fields from 1992 were surveyed in 1993 due to the high precipitation conditions (a majority of corn acres were not planted). Breeding bird abundance was typically higher on the ORG and TNT systems, as significant differences were found for red-winged blackbirds *(Agelaius phoeniceus*), yellow-headed blackbirds *(Xanthocephalus xanthocephalus*), and total birds. Species richness was also significantly higher on the ORG and TNT systems.

Bird abundance in soybean fields was typically higher on the ORG and TNT farming systems. Mourning dove *(Zenaida macroura*) abundance was significantly higher on the TNT system in 1993, while red-winged blackbird, yellow-headed blackbird, common grackle *(Quiscalus quiscula*), and killdeer abundance was significantly higher on the TNT and/or ORG systems in 1994. Both total bird abundance and species richness were higher on the ORG and TNT farming system.

Stubble soybean fields from 1992 were also surveyed in 1993 due to the wet conditions. Yellow-headed blackbird abundance was significantly higher on the TNT system, however no other differences were found. Species richness was higher on the TNT system.

Alfalfa field surveys showed breeding bird abundance to be typically higher on the ORG system compared to the CON system (no alfalfa fields available on the TNT system). Grasshopper sparrow *(Ammodramus savannarum)* abundance was significantly higher on the ORG system in 1993 and 1994 as was song sparrow *(Melospiza melodia)*, dickcissel *(Spiza americana)*, and brown-headed cowbird (*Molothrus ater*) abundance in 1994. Yellow-headed blackbird abundance was significantly higher on the CON system in 1994. Total bird abundance was higher on the ORG system both years, however significant in 1994. Species richness was significantly higher on the ORG system both years.

Breeding bird abundance in oat fields for specific individual species was higher on the ORG system, however others were higher on the CON system. Western meadowlark *(Sturnella neglecta)* and dickcissel abundance was significantly higher on the CON system. Total bird abundance was also higher on the CON system, however species richness was significantly higher on the ORG system.

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